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PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET,
1887.

These experiments, it is true, are not easy; still they are in the power of every thinking husbandman. He who accomplishes but one, of however limited application, and takes care to report it faithfully, advances the science, and, consequently, the practice of agriculture, and acquires thereby a right to the gratitude of his fellows, and of those who come after. To make many such is beyond the power of most individuals, and cannot be expected. The first care of all societies formed for the improvement of our science should be to prepare the forms of such experiments, and to distribute the execution of these among their members.

Von Thaer, *Principles of Agriculture.*

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET AND CHARING CROSS.

CONTENTS OF PART I., VOLUME XXIII.

SECOND SERIES.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios. and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839–40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

ERRATUM.

On page 156, line 28, of Vol. XXII., *for* "640" *read* "240" quarts.

STATISTICS

AFFECTING BRITISH AGRICULTURAL INTERESTS.

Revised by W. Leigh Bernard, Barrister-at-Law, F.S.S.

Contents.

Prefatory Note.

The practical importance of the statistics bearing on British Agriculture, in connection with the agricultural industries of the world, having been brought under the consideration of the Council, it has been decided to enlarge the number of subjects treated on in future numbers of the Journal, and, so far as the nature of the difficult masses of figures to be handled will permit, to condense the statistical matter into a shape calculated to render it digestible food for thought. In dealing with "statistics," it may perhaps be useful to recollect that the term

was invented by "Achenwall," to express that which in his mind was "history divested of its least interesting details," and that, without exception, between statistics and all other sciences there is a broad line of separation—other sciences deal with matters that are not of man's making, and over which he can exercise few or no modifying influences, whilst in the case of statistics, we are dealing with a mixed mass of facts, brought about in part only by Nature, and largely influenced by every change of custom, every constitutional reform, every social disturbance, and every effort of legislation. Peace and war, geographical dislocations, commercial and fiscal fluctuations, fresh fields of enterprise, all combine to modify the groundwork on which the industries of the world were formerly based, and render it essential for British Agriculturists to keep themselves well informed as to the agricultural statistics of the competing world. It may be repeated with advantage, that which has been said with great truth, "statistics appeal forcibly to the sense of sight which is recognised as so important an aid to conception and memory." In fact, we are every day more and more indebted for the most valuable discoveries in the vast and ever-changing relations of cause and effect to the logical principles engendered by statisticians for the discovery of truth.

The Board of Trade Reports on Emigration and Immigration afford a striking example of the value of statistics, and we have the high authority of the 'Times'* for stating that these reports "are gradually bringing to light the presence of fixed laws in the matter, and already we can predict the course of the currents of human beings with as much accuracy as the movements in the export and import of commodities. Here the science of statistics has won not its least victory. All the speculative ingenuity of economists could not have foretold the exact proportion between emigration and immigration. . . . Perhaps some time other branches of political knowledge will come under the influence of the same statistical process, and when this change happens a politician will have to learn his trade, and will no more know its mysteries intuitively than a seaman knows navigation, or a surgeon anatomy, by the light of Nature."

* *Vide* 5th March, 1887.

METEOROLOGY.*—1886.

First Quarter (*January, February, March*).—The mean reading of the barometer at Greenwich was 29·737 inches, and was 0·027 below the mean reading for the corresponding period of 45 years; the mean reading was below the average in January and March, while that in February was above the average.

The weather in January, after the first five days, was cheerless and cold; snow fell on every day in the month from the 4th, with the exception of the 14th, at one or other of the stations; on several days it fell at all stations. The temperature of the air was above the average till the 5th day, as well as on the 13th, 14th, and 15th, and on the last day; but on all other days it was below. The atmospheric pressure was generally below its average, particularly on the 13th, when the weather was very stormy with very high wind; the mean pressure for the month was lower than in any January since 1872 when it was 29·463 in., and back to 1841 there have been only two other instances of so low a pressure, viz., in the years 1856 and 1865.

The weather in February was very cold and dull, with scarcely any sunshine. Snow fell on the 1st, 3rd, 4th, 5th, and 6th, and every day from the 14th to the end of the month, mostly at the stations in the Midland and Northern districts. The temperature of the air was below its average on every day, excepting the 13th and 14th, and particularly so from the 7th to the 10th, and from the 23rd. The mean temperature of the month was lower than in any February back to 1855, which was the coldest February this century. The atmospheric pressure was generally above its average. There was an excess of N. and E. winds.

The weather in March till the 18th day was very cold, being nearly 10° below the average, then there was a sudden change to warm weather, the remaining 12 days being $6\frac{1}{4}$° above the average. The atmospheric pressure was variable, being for several days together above, and then for several days together below the average. Snow fell on every day to the 6th, from the 12th to the 19th, and on the last three days of the month. The falls of snow at the beginning

* Abstracted from the particulars supplied to the Registrar-General by James Glaisher, Esq., F.R.S., &c.

of the month were general, and in the north were very heavy, causing serious interruption to railway traffic; the main line north of Newcastle was blocked for two or three days, and many trains were fast in the snow. Till the 18th there was an excess of E. winds; on the 19th a change of wind to S. and S.W. took place, which continued to the end of the month; there were thunder-storms on the 29th and 31st.

The *mean temperature* of the air for the quarter was 36°·5, and was 2°·3 above the average for the corresponding period of 115 years.

The *rainfall* measured at Greenwich during the quarter was 5·36 inches, and was 0·14 inches above the average amount in the corresponding period of 45 years. The rainfall was below the average in February and March, but in excess of the average in January. Rain was measured at Greenwich on 22 days in January, 10 in February, and 15 in March, or on 47 of the 90 days in the quarter. The rainfall recorded at 41 stations of observation ranged from 4·31 inches at Cambridge, 4·01 at Cardington, and 3·93 at Lowestoft, to 11·99 inches at Stonyhurst, 8·80 at Bath, 11·65 at Truro, and 11·60 at Torquay.

Second Quarter (*April*, *May*, *June*).—The mean reading of the barometer at Greenwich was 29·712 inches, and was 0·069 below the mean reading for the corresponding period of 45 years; the mean reading was below the average in April and May, while that in June was below the average.

The weather in April, after the first week, was cold and stormy till the 18th, and variable afterwards, being at times fine and warm till the 28th, which was a warm day, being 6°·0 above its average; a remarkable sudden fall of temperature took place during the afternoon of this day of 20°; on the 29th at 9 A.M. the temperature was fully 20° lower than on the 28th at the same hour, and the mean temperature of the day was 8½° below its average. The atmospheric pressure was generally below its average till the 11th day, and afterwards was for a few days together alternately a little in excess or defect of its average. The E. wind was unusually prevalent. Snow fell on eight days, chiefly in the Midland and Northern counties.

The weather in May after the first three days, and up to the 10th day, was fine and generally bright; after this, with the exception of a few days between the 18th and the 22nd, the remainder of the month was cold and stormy. The atmospheric pressure was generally above its average till the 9th, and between the 19th and the 23rd days, and was generally below during the remainder of

the month. There was very little rain till the 11th day; it then fell frequently till the 28th day; the falls on the 11th, 12th, and 13th were remarkable, particularly over the Western and the Midland counties, exceeding 2 inches in amount on the 12th day at many places; and the amount for these three days was 4 inches, or 5 inches, and in some places 6 inches, causing very serious floods in Hereford, Shropshire, and adjacent counties. The rainfall was in excess of its average at all stations. Snow fell on five days, the last on the 26th at Wolverhampton.

The weather in June excepting the first two days and the last week was cold, but was frequently bright and fine. The atmospheric pressure was variable, being for several days together in excess of the average, and then for several days below it; during the last week of the month it was above the average, and the weather was very fine. The rainfall was less than its average at all stations. There was very little either of thunder, lightning, hail, or fog. It was a fine month for securing the hay crop.

The *mean temperature* of the air for the quarter was 52°·5, and was 0°·2 above the average for the corresponding period of 115 years.

The *rainfall* measured at Greenwich during the quarter was 5·93 inches, and was 0·14 inches above the average amount for the corresponding period of 71 years. The rainfall was above the average in April and May, and below the average in June. Rain was measured at Greenwich on 12 days in April, 15 in May, and 9 in June, or on 36 of the 91 days in the quarter. The rainfall recorded at 37 stations of observation ranged from 3·92 inches at Somerleyton, and 4·66 inches at Cambridge, to 10·38 inches at Halifax, and 12·81 inches at Stonyhurst.

Third Quarter (*July, August, September*).—The mean reading of the barometer at Greenwich was 29·806 inches, and was 0·014 above the mean reading for the corresponding period of 45 years; the mean reading was above the average in August and September, while that in July was below the average.

The weather during the first week in July was very fine and warm, with an almost cloudless sky, the temperature being as high as 90° at Osborne, and exceeding 85° at many stations south of latitude 53°, but did not reach much above 80° at northern stations. From the 9th to the end of the month, with the exception of the five days, the 18th to the 22nd, the weather was cold and dull. The atmospheric pressure was variable, being mostly above its average till the 11th, and chiefly below afterwards. No rain fell till the 11th day, then it fell nearly on every day till the 26th.

The weather in August was mostly cold and damp, with an overcast sky, till the 20th day, and fine and warm afterwards. The temperature towards the end of the month exceeded 85° at many places between the latitudes 51° and 53°, but not at places either south or north of those parallels; the highest temperature at those stations was below 80°. The atmospheric pressure was below its average during the first two days, then for a week it was above, then variable till the 16th, and mostly above from the 17th. Rain fell occasionally till the 16th, and the weather was fine and dry afterwards.

The weather in September was generally very fine; the temperature on the 1st was high, exceeding 80° at many places in the south and in the Midland counties, but not in Cornwall or Devonshire, or in the north. A great change took place on the second day about London; on the 1st at 5 P.M. the temperature was 83°, and at 5 P.M. on the 2nd it was 56°. The mean temperature of the 1st day was 72°, and of the 2nd was 59°, and that of the 3rd was 63°. On the 3rd day a series of thunderstorms and heavy rains set in all over the country, and continued through the 4th and 5th days; in some places the falls of rain were very heavy, but local, a good deal of mischief was done by the lightning, and some animals were killed at different parts of the country; the full force of the storm was experienced in Wales. About London thunder was heard on the 4th, but there was no storm. The temperature continued high till the 9th day; from the 15th to the 26th the weather was fine but rather cold, and was again warm at the end of the month. The atmospheric pressure was high both at the beginning and ending of the month, and did not differ much from its average at other times. It was a fine harvest month.

The *mean temperature* of the air during the quarter was 61°·2, and was 1°·5 higher than the average for the corresponding period of 115 years.

The *rainfall* measured at Greenwich during the quarter was 4·87 inches, and was 2·46 inches below the average amount in the corresponding period of 71 years. The rainfall was below the average in August and September, and above the average in July. Rain was measured at Greenwich on 13 days in July, 10 in August, and 10 in September, or on 33 of the 92 days in the quarter. The rainfall recorded at 36 stations of observation ranged from 4·46 inches at Blackheath, 4·86 inches at Camden Square, and 4·87 inches at Royal Observatory and Barnet, to 9·86 inches at Carlisle, 12·37 inches at Stonyhurst, and 16·08 inches at Lancaster.

Fourth Quarter (*October, November, December*).—The mean reading

of the barometer at Greenwich was 29·624 inches, and was 0·125 lower than the mean reading for the corresponding period of 45 years; the mean reading was below the average in October and December, while in November it was above the average.

The weather in October during the first 12 days, and from the 19th was warm, particularly during the first week; the temperature at the Royal Observatory, Greenwich, rising to 79°·2 on the 4th, a point higher than in any October back to 1859, when it was 81°·1, and to 77° on the 5th; the mean temperature of the 4th and 5th days was more than 10° above the average. The month was warmer than any October back to 1861. The fall of rain was above its average at most stations. The atmospheric pressure was above its average till the 8th and from the 21st, and below from the 9th to the 20th, particularly so on the 15th, 16th, and 17th days.

The weather in November was generally unsettled; the temperature was variable, being for a few days together above the average, and then for a few days together below. The atmospheric pressure was generally below its average till the 17th, and generally above from the 18th. The fall of rain was generally less than the average; about London it was a little in excess of average; it fell frequently till the 20th day. The wind was mostly from the S.W.; the latter part of the month was cloudy, foggy, and dull.

The weather in December was for the most part dull and cold, and very exceptional; the temperature in the first week was very low; on the 2nd day it was more than 10° below its average, and on the 3rd day was nearly 14° below its average; from the 6th to the 15th it was mostly mild, and very cold from the 16th to the end of the month, particularly so on the 18th, 19th, 20th, and 21st; the mean temperature of these four days was 27°, or $12\frac{3}{4}$° below their average. The atmospheric pressure was very remarkable; till the 5th day it was a little in excess of its average, and then nearly constantly below till the 29th day, and particularly so on the 8th and 9th, whose average daily pressure was nearly 1·4 inch below their averages. The low readings of the barometer on the 8th and 9th were very extraordinary: at Blackheath on the 8th the reading was nearly stationary from 8 P.M. to near midnight at 28·157 inches; it then rose to 28·16 inches by 2 A.M. on the 9th, and then decreased to 28·14 inches by 7 A.M., a point lower than any reading since 1843, on January 13th, when it was 28·096 inches. Rain fell on five days out of six at southern stations, and was above its average at all stations; on the 26th rain fell at

Blackheath to the depth of 0·24 inch by 5 P.M.; after this snow began to fall, and was 8 inches in depth at 10 P.M.; it continued to fall till 2 or 3 o'clock on the 27th, and at 8 A.M. on level places there was snow to the depth of 12 inches. The density of this snow caused great injury to telegraph poles, and broke off many branches of trees.

The *mean temperature* of the air during the quarter was 44°·6, and was 0°·9 above the average for the corresponding period in 115 years.

The *rainfall* measured at Greenwich during the quarter was 8·03 inches, and was 0·91 inches above the average amount in the corresponding period of 71 years. The rainfall was above the average in November and December, and below the average in October. Rain was measured at Greenwich on 14 days in October, 15 in November, and 18 in December, or on 47 of the 92 days in the quarter. The rainfall recorded at 36 stations of observation ranged from 8·03 inches at Royal Observatory, 8·38 inches at Blackheath, and 8·47 inches at Lowestoft, to 18·31 inches at Guernsey, 19·27 inches at Bath, and 19·67 inches at Barnstaple.

Wind Observations.—The number of days the wind blew at eight points of the compass in each month of 1886, at the Royal Observatory, Greenwich, was as follows:—

Months.	Direction of Wind.							
	N.W.	N.	N.E.	E.	S.E.	S.	S.W.	W.
	days.	days.	days.	days.	days.	days.	days.	days.
January ..	7·00	1·50	1·75	4·50	4·75	2·25	7·75	1·00
February ..	4·50	3·25	5·00	8·25	1·25	1·00	0·50	0·75
March ..	2·25	0.75	4·25	8·00	0·75	2·00	10·75	2·25
April ..	2·00	3·25	5·50	8·00	0·00	2·75	5·25	2·75
May	1·00	0·25	1·75	10·50	1·75	4·50	6·75	4·50
June	4·75	4·75	2·00	7·75	0·25	1·50	3.50	5·50
July	2·00	3·00	0·00	2·00	1·00	7·00	11·00	5·00
August ..	7·00	1·00	2·00	0·00	0·00	2·00	16·00	3·00
September	2·50	1·50	8·50	0·00	0·50	2·00	13·00	2·00
October ..	1·00	1·00	4·00	2·00	8·00	2·00	12·00	1·00
November ..	5·00	0·50	5·50	1·00	2·00	1·50	13·00	1·50
December ..	7·00	2·00	3·00	0·00	3·00	3·00	9·00	4·00
Totals for 1886 ..	46·00	22·75	43·25	52·00	23·25	31·50	108·50	33·25

The following tables give the Meteorological Observations recorded at the Royal Observatory, Greenwich, for each month of the year 1886.

TABLE I.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, FOR THE YEAR 1886.

1886. MONTHS.	Temperature of Air. Mean.	Air. Diff. from average of 115 years.	Air. Diff. from average of 45 years.	Evaporation. Mean.	Evaporation. Diff. from average of 45 years.	Dew Point. Mean.	Dew Point. Diff. from average of 45 years.	Air—Daily Range. Mean.	Air—Daily Range. Diff. from average of 45 years.	Elastic Force of Vapour. Mean.	Elastic Force of Vapour. Diff. from average of 45 years.	Weight of Vapour in a Cubic Foot of Air. Mean.	Weight of Vapour. Diff. from average of 45 years.
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
January	36·1	−0·4	−2·4	34·7	−2·2	32·7	−2·2	9·9	+0·4	0·186	−0·015	2·2	−0·2
February	33·7	−5·0	−6·0	32·4	−5·6	30·2	−5·3	8·2	−2·9	0·168	−0·042	2·0	+0·4
March	39·6	−1·5	−2·1	37·2	−2·1	33·9	−2·1	13·8	−1·0	0·195	−0·022	2·4	−0·1
Means	36·5	−2·3	−3·5	34·8	−3·3	32·3	−3·2	10·6	−1·2	0·183	−0·026	2·2	+0·2
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
April	46·4	+0·8	−0·7	44·0	+0·1	41·1	+0·6	16·9	−1·5	0·258	+0·005	3·0	+0·1
May	53·3	+0·8	+0·8	49·4	+0·6	45·5	+0·5	20·4	−0·1	0·305	+0·007	3·4	+0·1
June	57·8	−0·4	−1·1	53·1	−1·4	48·9	−1·8	21·7	+0·7	0·346	−0·024	3·8	−0·4
Means	52·5	+0·2	−0·4	48·8	−0·2	45·2	−0·2	19·7	−0·3	0·303	−0·002	3·4	−0·1
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
July	63·0	+1·3	+0·8	57·9	+0·2	53·2	−0·8	22·2	+1·2	0·406	−0·012	4·5	−0·2
August	62·0	+1·1	+0·6	58·4	+1·0	55·5	+1·6	20·5	+0·7	0·441	+0·023	4·9	+0·2
September	58·7	+2·1	+0·6	55·1	+1·1	52·0	+0·8	18·9	+0·7	0·388	+0·008	4·3	−0·1
Means	61·2	+1·5	+0·7	57·1	+0·8	53·6	+0·5	20·5	+0·9	0·412	+0·006	4·6	0·0
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
October	53·3	+3·8	+3·4	51·3	+3·4	49·2	+3·4	13·4	− 1·1	0·351	+0·042	3·9	−0·1
November	44·0	+1·6	+0·5	42·6	+1·3	41·1	+1·7	11·5	0·0	0·258	+0·013	2·9	+0·1
December	36·5	−2·6	−2·3	35·0	−3·5	32·7	−3·7	10·2	+ 0·9	0·186	−0·033	2·2	−0·4
Means	44·6	+0·9	+0·5	43·0	+0·4	41·0	+0·5	11·7	− 0·1	0·265	+0·007	3·0	−0·1

NOTE.—In reading this Table it will be borne in mind that the *minus* sign (−) signifies *below* the average, and that the *plus* sign (+) signifies *above* the average.

TABLE II.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE YEAR 1886.

1886.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was				
MONTHS.	Mean.	Diff. from average of 45 years.	Mean.	Diff. from average of 45 years.	Mean.	Diff. from average of 45 years.	Amount.	Diff. from average of 71 years.		At or below 30°.	Between 30° and 40°.	Above 40°.	Lowest Reading at Night.	Highest Reading at Night.
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
January ..	88	+ 1	29·475	−0·280	551	− 3	3·67	+1·79	354	18	12	1	16·5	41·9
February ..	87	+ 2	29·945	+0·159	563	+10	0·56	−1·01	206	16	12	0	18·9	34·9
March ..	80	− 1	29·792	+0·040	553	+ 3	1·13	−0·37	342	18	6	7	17·2	47·1
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	85	+ 1	29·737	+0·027	556	+ 3	5·36	+0·14	301	52	30	8	16·5	47·1
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
April ..	81	+ 2	29·743	−0·004	544	+ 1	1·26	−0·49	355	1	27	2	24·0	41·1
May	76	− 3	29·758	−0·030	537	− 3	4·23	+2·18	255	6	13	12	18·8	50·2
June ..	73	− 2	29·805	−0·002	533	+ 1	0·44	−1·55	259	1	10	19	28·6	47·8
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	77	− 1	29·769	−0·012	538	0	5·93	+0·14	290	8	50	33	18·8	50·2
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July	72	− 3	29·747	−0·051	526	− 2	2·51	0·00	256	0	4	27	37·9	53·8
August ..	79	+ 3	29·816	+0·033	528	− 1	1·12	−1·25	223	0	3	28	34·7	58·2
September	79	− 2	29·856	+0·059	532	− 1	1·24	−1·21	279	0	12	18	31·0	56·1
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	77	− 1	29·806	+0·014	529	− 1	4·87	−2·46	253	0	29	73	31·0	58·2
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
October ..	86	− 2	29·618	−0·092	534	− 6	1·41	−1·40	203	1	13	17	28·9	48·1
November	89	0	29·732	−0·010	547	− 1	3·02	+0·69	253	9	19	2	23·4	41·0
December ..	86	− 2	29·522	−0·273	551	− 2	3·60	+1·62	367	20	10	1	15·0	44·0
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	87	− 1	29·624	−0·125	544	− 3	8·03	+0·91	274	30	42	20	15·0	48·1

NOTE.—In reading this Table it will be borne in mind that the *plus* sign (+) signifies *above* the average, and that the *minus* sign (−) signifies *below* the average.

Table III.—HAY HARVEST FORECASTS, 1886.

"Sir,

"I beg to submit herewith the results of the checking of the Hay Harvest Forecasts for 1886.

"The issue of the forecasts commenced with those for England N.E., England E., Midland counties, and England S., on the 17th June, those for other districts were added as the season advanced.

"The result of this year's checking shows that the general percentage of successful forecasts has been slightly higher than in the preceding year. The largest percentage (89) was reached in England, E., while the smallest (74) was in Ireland, N.

"Several of the recipients have voluntarily borne testimony to the success of the forecasts this year. Mr. Birkbeck, of Norwich, states that 'the forecasts have again been remarkably correct.' Mr. McGarva, the agent for Mr. Stewart, of Ardwell, Stranraer, remarks that 'the forecasts have been quite correct,' and another subscriber, Mr. McCready, of Moneygall, Roscrea, also says the forecasts have been 'remarkably correct.' Mr. Neville-Grenville, of Butleigh Court, Glastonbury, has spoken very highly of them to myself when calling at the office to make an inquiry.

"I am, &c.,

(Signed) "Fredc. Gaster.

"*To* R. H. Scott, Esq.,

"*Secretary, Meteorological Council.*"

Summary of Results.

Districts.	Names of Stations.	Percentages.				Total Percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
Scotland, N. ..	Golspie and Munlochy ..	62	24	11	3	86
Scotland, E. ..	Longniddry, Aberfeldy, Braco, and Glamis ..	46	41	7	6	87
England, N.E. ..	Ulceby and Chatton, Northumberland ..	52	33	14	1	85
England, E. ..	Rothamsted and Thorpe	47	42	9	2	89
Midland Counties	Cirencester and East Retford	43	39	18	..	82
England, S. ..	Horsham, Maidstone, and Downton	49	38	12	1	87
Scotland, W. ..	Dumbarton, Stranraer, and Islay	66	20	13	1	86
England, N.W. ..	Leyburn, Knutsford, and Prescot	57	27	14	2	84
England, S.W. ..	Bridgend (Glamorgan), Clifton, Glastonbury, and Falfield	57	26	14	3	83
Ireland, N... ..	Hollymount and Moynalty	48	26	14	12	74
Ireland, S.	Moneygall and Kilkenny	54	31	13	2	85
	Mean for all districts..	53	31	13	3	84

TABLE IV.—HAY HARVEST

RETURN SHOWING THE NUMBER OF FORECASTS SENT TO EACH
OTHERWISE OF

Districts.	To whom sent.	Address.
0. Scotland, N. ..	Rev. Dr. Joass	Golspie .. ..
	Major Smith	Munlochy, Inverness .. ..
1. Scotland, E. ..	W. S. Macdonald ..	Craigielaw, Longniddry ..
	C. W. L. Forbes ..	Aberfeldy .. ..
	A. F. Leslie .. .	Braco, Keith .. ..
	G. Johnstone	Glamis, by Forfar .. .. ..
2. England, N.E. ..	J. Turner	The Grange, Ulceby .. ..
	Jacob Wilson	Chillingham Barns, Chatton, Northumberland .. ..
3. England, E. ..	Sir J. B. Lawes, Bart.	Rothamsted, Harpenden ..
	W. Birkbeck	High House, Thorpe, Norwich
4. Midland Counties	Professor H. Ohm ..	Royal Agricultural College, Cirencester .. ..
	E. E. Harcourt-Vernon	Grove Hall, East Retford ..
5. England, S. ..	G. M. Allender	Stammerham, Horsham ..
	C. Whitehead	Barming House, Maidstone ..
	E. P. Squarey	The Moot, Downton, Wilts ..
6. Scotland, W. ..	W. Calder	Castlehill, Dalreock, Dumbarton .. ..
	M. J. Stewart	Ardwell, Stranraer .. ..
	J. S. R. Ballingal ..	Eallabus House, Islay .. ..
7. England, N.W...	G. W. Wray	Leyburn, Yorks .. .. ..
	J. F. Smith, for Lord Egerton of Tatton	Tatton Park, Knutsford ..
	F. Harrison, for the Earl of Derby ..	Knowsley Gardens, Prescot
8. England, S.W. ..	Colonel T. Picton Turberville	Ewenny Priory, Bridgend, Glamorganshire .. ..
	T. Dyke	Long Ashton, Clifton, Bristol
	R. Neville-Grenville	Butleigh Court, Glastonbury
	J. Harle, for the Earl of Ducie	Whitfield, Falfield, R.S.O. ..
9. Ireland, N. ..	Rev. A. Brown	The Manse, Hollymount, Co. Mayo .. ..
	E. F. Farrell	Moynalty, Kells, Co. Meath ..
10. Ireland, S.	D. A. McCready ..	Larchvale, Moneygall, Roscrea .. ..
	W. Talbot Crosbie ..	Ardfert Abbey, Tralee ..
	D. A. Milward	Lavistown, Kilkenny .. ..

FORECASTS, 1886.

OF THE UNDERMENTIONED PERSONS, WITH THE SUCCESS OR THE FORECASTS.

No. of Forecasts sent.	No. of Forecasts checked.	Percentages. Complete Success.	Partial Success.	Partial Failure.	Total Failure.	Remarks.
30	30	50·0	36·7	13·3	..	During the progress of the service Major Smith frequently alluded to the accuracy of the forecasts.
30	30	73·3	10·0	10·0	6·7	
30	24	45·8	37·5	4·2	12·5	
30	30	40·0	50·0	10·0	..	Mr. Johnstone says, "I may tell you how very highly your telegrams are appreciated. * * * Agriculturists are ever on the look out for them."
30	30	40·0	50·0	10·0	..	
30	30	60·0	30·0	6·7	3·3	
27	24	41·7	37·5	20·8	..	
58	58	62·1	29·3	6·9	1·7	
27	21	42·9	42·8	14·3	..	Mr. Birkbeck remarked that "the forecasts have again been remarkably correct."
27	27	51·9	40·7	3·7	3·7	
27	27	44·5	37·0	18·5	..	
33	32	40·9	40·9	18·2	..	
27	27	37·0	48·2	14·8	..	
27	27	63·0	29·6	7·4	..	
27	27	48·2	33·3	14·8	3·7	
30	30	66·7	20·0	10·0	3·3	
30	30	66·7	30·0	3·3	..	Mr. McGarva, agent for Mr. Stewart, states that "the forecasts have been quite correct."
30	23	65·2	8·7	26·1	..	
27	24	66·6	29·2	4·2	..	
78	72	40·3	33·3	20·8	5·6	
27	27	63·0	18·5	18·5	..	
30	30	53·4	23·3	13·3	10·0	
18	18	61·1	27·8	11·1	..	
30	30	60·0	20·0	20·0	..	
30	30	53·4	33·3	13·3	..	
30	30	50·0	23·4	13·3	13·3	
42	41	46·3	29·3	14·6	9·8	
30	30	56·7	36·7	6·6	..	Mr. McCready says that the forecasts have been "remarkably correct."
30		No weather record kept.				
30	30	50·0	26·7	20·0	3·3	

CORN: Importations, Sales, and Prices.

[*From Board of Trade Returns.*]

Table V.—Quantities of Wheat, Wheatmeal, and Flour, Barley, Oats, Peas and Beans, Imported into the United Kingdom in the Year 1886.

1886.	Wheat.	Wheatmeal and Flour.	Barley.	Oats.	Peas.	Beans.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January ..	3,314,235	978,418	1,037,869	622,863	105,585	214,271
February	2,441,448	890,839	517,337	471,970	74,024	276,811
March ..	3,459,679	965,297	475,242	300,743	163,291	232,102
April ..	2,452,108	947,732	602,746	881,705	107,209	151,241
May ..	3,930,345	1,513,451	574,335	1,099,215	120,018	245,385
June ..	6,129,858	1,351,434	516,495	1,585,468	152,569	423,478
In first Six Months	21,727,673	6,647,171	3,724,024	4,961,964	722,696	1,543,288
July.. ..	4,727,829	1,389,402	508,022	1,208,767	248,712	95,605
August ..	4,125,486	1,341,334	245,011	1,352,841	230,404	274,952
September	5,247,644	1,458,451	1,875,335	1,531,006	135,976	191,894
October ..	4,155,338	1,406,561	2,796,693	1,297,994	218,299	214,525
November	4,068,863	1,222,165	2,720,270	2,114,895	249,305	199,590
December	3,351,511	1,274,148	1,853,254	1,027,723	241,761	284,478
In last Six Months	25,676,671	8,092,061	9,998,585	8,533,226	1,324,457	1,261,044
Year ..	47,404,344	14,739,232	13,722,609	13,495,190	2,047,153	2,804,332

Note.—The average weights *per quarter* of corn, as adopted in the office of the Inspector-General of Imports and Exports, are as follow:—For wheat, 485⅓ lbs., or 4⅓ cwts.; for barley, 400 lbs., or 34/7 cwts.; for oats, 308 lbs., or 2¾ cwts. Corn has been entered by *weight* instead of *measure* since September, 1864. No duty has been charged since 1st June, 1869.

Table VI.—Computed Real Value of Corn Imported into the United Kingdom in each of the Seven Years, 1880-86.

	1880.	1881.	1882.	1883.	1884.	1885.	1886.
	£.	£.	£.	£.	£.	£.	£.
Wheat ..	30,604,285	31,466,804	34,237,099	31,434,888	19,825,021	24,066,013	17,888,155
Barley ..	4,998,442	4,069,402	5,541,498	5,784,504	4,228,722	4,528,823	3,968,437
Oats ..	4,946,440	3,781,013	4,603,983	5,043,011	4,195,514	4,252,135	3,974,434
Maize ..	11,141,642	10,392,460	6,522,070	10,314,307	7,303,099	8,473,863	7,614,113
Other kinds	1,920,787	1,617,820	1,637,282	2,114,289	1,820,366	1,758,105	1,512,985
Wheat Flour	8,721,269	9,205,807	10,631,933	12,318,144	10,166,010	9,651,508	8,254,407
Other kinds of Flour	36,845	24,007	21,966	31,038	23,970	18,811	12,899
Total of Corn ..	62,369,710	60,557,313	63,195,831	67,040,181	47,562,702	52,749,258	43,225,430

Table VII.—Quantities of British Wheat Sold in the Towns from which Returns are received under the Act of the 27th & 28th Victoria, cap. 87, and their Average Prices, in each of the Twelve Months of the Years 1880–86.

[*From the 'London Gazette.'*]

	Quantities in Quarters.						
	1880.	1881.	1882.	1883.	1884.	1885.	1886.
	quarters.	quarters.	quarters.	quarters.	quarters.	quarters.	quarters.
First month ..	124,422	122,533	181,182	178,386	200,335	252,271	191,045
Second month	142,857	119,219	175,829	214,412	214,935	257,613	284,566
Third month (five weeks)	136,613	164,942	169,155	276,485	289,987	256,861	352,929
Fourth month	106,170	120,177	142,321	228,550	189,663	194,853	213,269
Fifth month ..	104,125	130,235	143,861	271,744	245,637	206,924	251,653
Sixth month (five weeks)	127,132	113,386	112,818	248,770	180,893	200,421	232,931
Seventh month	71,622	57,333	51,130	129,768	113,424	133,407	122,084
Eighth month	54,641	49,329	42,363	150,769	132,773	139,177	168,135
Ninth month (five weeks)	153,752	197,351	229,765	291,157	358,231	268,689	192,535
Tenth month	197,757	231,960	217,416	289,858	291,763	295,065	246,399
Eleventh month	172,153	194,080	192,704	278,749	257,483	232,891	196,476
Twelfth month (five weeks)	218,641	215,547	245,290	342,517	310,903	303,318	284,798

	Average Prices per Quarter.													
	1880.		1881.		1882.		1883.		1884.		1885.		1886.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
First month ..	46	2	42	7	45	8	40	3	38	8	33	5	29	11
Second month	44	0	41	10	46	0	41	0	37	4	33	4	29	6
Third month (five weeks)	56	5	42	11	44	9	42	4	37	7	31	11	29	9
Fourth month	48	2	44	8	46	2	41	11	37	5	34	2	30	7
Fifth month ..	45	4	44	6	47	4	43	2	37	10	37	1	31	8
Sixth month (five weeks)	45	1	44	9	47	4	42	10	37	2	33	9	31	9
Seventh month	43	9	46	8	48	10	42	2	37	0	33	8	31	0
Eighth month	44	0	48	7	50	0	43	7	37	5	33	6	32	2
Ninth month (five weeks)	41	9	51	4	44	0	41	10	34	0	31	8	32	2
Tenth month ..	41	4	47	0	39	8	40	5	32	4	30	11	29	11
Eleventh month	43	7	45	11	40	10	40	3	31	8	31	1	30	10
Twelfth month (five weeks)	44	2	44	7	41	5	39	7	31	0	30	7	33	0

Table VIII.—Average Prices of British Corn per Quarter (Imperial measure) as received from the Inspectors and Officers of Excise according to the Act of 27th & 28th Victoria, cap. 87, in each of the Fifty-two Weeks of the Year 1886.

[*From the 'London Gazette.'*]

Week ending	Wheat.		Barley.		Oats.		Week ending	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.
January 2..	30	3	29	1	18	1	July 3..	31	0	24	2	21	4
January 9..	29	10	28	10	18	1	July 10..	30	9	23	5	20	1
January 16..	29	10	28	11	18	5	July 17..	31	0	22	4	20	2
January 23..	29	9	29	7	18	7	July 24..	31	3	23	9	20	7
January 30..	29	7	28	8	18	10	July 31..	32	0	25	10	20	7
February 6..	29	9	29	3	18	10	August 7..	31	8	22	10	21	2
February 13..	29	6	29	0	19	4	August 14..	32	6	23	10	20	2
February 20..	29	4	28	5	18	10	August 21..	32	7	22	4	21	4
February 27..	29	3	28	3	19	2	August 28..	33	2	24	5	21	2
March 6..	29	0	28	1	19	5	September 4	33	1	25	4	19	8
March 13..	29	9	28	6	19	1	September 11	32	5	29	0	19	0
March 20..	30	1	27	11	19	6	September 18	31	3	28	1	18	0
March 27..	30	9	27	6	19	5	September 25	30	9	27	5	18	1
Average of Winter Quarter	29	9	28	7	18	10	Average of Summer Quarter	31	9	24	10	20	1
April 3..	30	5	27	10	19	4	October 2..	30	3	27	4	17	6
April 10..	30	4	27	2	19	6	October 9..	30	0	26	9	17	8
April 17..	30	10	27	7	19	3	October 16..	29	8	27	4	16	9
April 24..	30	11	27	0	19	5	October 23..	29	9	27	4	16	11
May 1..	31	1	26	7	19	11	October 30..	30	3	27	7	17	7
May 8..	31	5	25	10	20	0	November 6	30	8	28	1	16	11
May 15..	31	11	25	3	20	3	November 13	31	0	27	8	17	0
May 22..	32	4	25	6	20	10	November 20	31	4	27	6	17	1
May 29..	32	5	23	6	20	4	November 27	31	11	27	7	16	7
June 5..	32	2	24	5	20	4	December 4	32	7	27	2	17	1
June 12..	31	11	25	2	20	2	December 11	33	1	27	0	16	9
June 19..	31	4	24	1	21	2	December 18	33	4	26	7	16	7
June 26..	31	1	24	11	20	10	December 25	33	11	26	4	16	7
Average of Spring Quarter	31	4	25	9	20	1	Average of Autumn Quarter	31	4	27	3	17	0
Average prices for year 1886	31	0	26	7	19	0							

Note.—For average prices of preceding years, see Table XIII

TABLE IX.—QUANTITIES of WHEAT, BARLEY, OATS, PEAS, BEANS, INDIAN CORN or MAIZE, WHEATMEAL, and FLOUR, IMPORTED in the FIVE YEARS 1882–86; also the COUNTRIES from which the WHEAT, WHEATMEAL, and FLOUR were obtained.

[*From Board of Trade Returns.*]

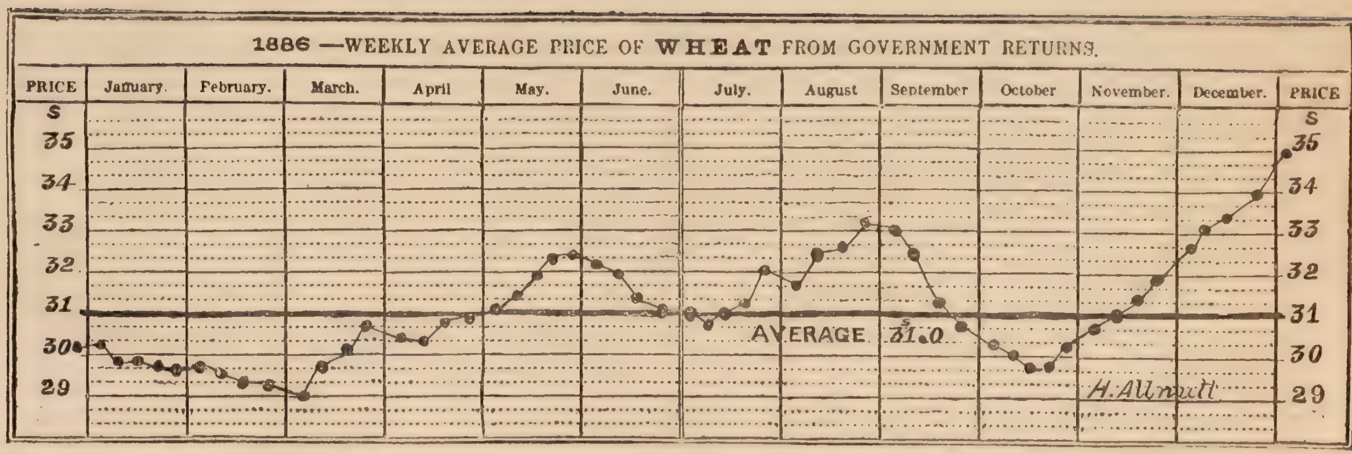
	1882.	1883.	1884.	1885.	1886.
Wheat from—	cwts.	cwts.	cwts.	cwts.	cwts.
Russia	9,571,021	13,293,358	5,401,964	11,986,359	3,710,099
Denmark	*	*	*	*	*
Germany	3,083,921	2,871,095	1,090,368	1,982,772	1,318,053
France	7,379	9,498	19,023	2,662	2,560
Turkey and Roumania ..	721,030	1,532,011	504,613	1,062,901	538,874
Egypt	174,862	1,174,391	999,578	109,983	40,632
United States	35,059,623	26,065,832	22,606,130	24,278,719	24,621,228
Chili	1,656,361	2,310,126	1,055,964	1,623,215	1,701,695
British India	8,477,479	11,243,497	8,009,909	12,101,963	11,028,665
Australasia	2,475,127	2,691,614	4,897,766	5,279,230	738,699
British North America ..	2,684,828	1,798,056	1,757,406	1,745,542	3,080,964
Other countries	259,991	1,090,966	771,277	1,280,455	622,875
Total Wheat ..	64,171,622	64,080,444	47,113,998	61,453,801	47,404,344
Barley	15,519,850	16,593,784	12,987,293	15,391,685	13,722,609
Oats	13,646,151	15,248,467	12,936,189	13,061,811	13,495,190
Peas	2,100,197	1,879,618	1,935,432	2,003,562	2,047,153
Beans	2,074,293	3,578,121	3,519,550	3,514,664	2,804,332
Indian Corn, or Maize ..	18,255,285	31,538,952	24,794,624	31,467,638	30,998,278
Wheatmeal and Flour from—					
Germany	1,990,403	1,928,769	1,746,514	1,415,046	816,737
France	220,269	163,898	154,349	187,097	114,594
United States	7,777,262	11,270,918	10,340,567	11,728,468	11,473,192
British North America ..	339,305	469,460	688,925	280,479	770,530
Other countries	2,701,466	2,460,484	2,173,163	2,224,102	1,564,179
Total Wheatmeal and Flour	13,028,705	16,293,529	15,103,518	15,835,192	14,739,232
Indian Corn Meal	16,422	35,817	16,062	13,722	10,264

* Included under "Other Countries."

TABLE X.—AVERAGE PRICES of Consols, of Wheat, and of Meat; also the AVERAGE NUMBER of PAUPERS relieved on the *last day* of each Week; and the MEAN TEMPERATURE, in each of the Twelve Quarters ending December 31st, 1886.

[*From Returns of the Registrar-General.*]

Quarters ending	AVERAGE PRICES.						PAUPERISM.		Mean Tempe-rature.
	Consols (for Money).	Average Minimum Rate per Cent. of Discount charged by Bank of England.	Wheat per Quarter in England and Wales.		Meat per lb. at the Metropolitan Meat Market (by the Carcass).		Quarterly Average of the Number of Paupers relieved on the *last day* of each week.		
					Beef.	Mutton.	In-door.	Out-door.	
1884	£.		*s.*	*d.*					°
Mar. 31	$101\frac{6}{8}$	3·19	37	9	$4\frac{4}{8}d.$—$7\frac{6}{8}d.$ Mean $6\frac{1}{8}d.$	$5d.$—$8\frac{6}{8}d.$ Mean $6\frac{7}{8}d.$	186,636	536,767	43·4
June 30	$101\frac{7}{8}$	2·42	37	6	$4\frac{4}{8}d.$—$7\frac{5}{8}d.$ Mean $6\frac{1}{8}d.$	$5\frac{1}{8}d.$—$9d.$ Mean $7d.$	173,749	523,182	52·5
Sept. 30	$100\frac{6}{8}$	2·00	35	11	$4\frac{3}{8}d.$—$7\frac{6}{8}d.$ Mean $6\frac{1}{8}d.$	$4\frac{7}{8}d.$—$8\frac{7}{8}d.$ Mean $6\frac{7}{8}d.$	168,076	513,981	62·7
Dec. 31	$100\frac{6}{8}$	4·17	31	7	$4\frac{1}{8}d.$—$7\frac{4}{8}d.$ Mean $5\frac{7}{8}d.$	$4\frac{5}{8}d.$—$8d.$ Mean $6\frac{3}{8}d.$	181,776	518,811	44·1
1885									
Mar. 31	$98\frac{7}{8}$	4·24	32	9	$4d.$—$7d.$ Mean $5\frac{4}{8}d.$	$4\frac{2}{8}d.$—$7\frac{4}{8}d.$ Mean $5\frac{7}{8}d.$	189,718	546,688	40·3
June 30	$98\frac{2}{8}$	2·75	34	10	$4\frac{2}{8}d.$—$6\frac{6}{8}d.$ Mean $5\frac{4}{8}d.$	$4\frac{7}{8}d.$—$8\frac{1}{8}d.$ Mean $6\frac{4}{8}d.$	173,498	524,628	52·4
Sept. 30	$99\frac{7}{8}$	2·00	32	10	$3\frac{6}{8}d.$—$6\frac{6}{8}d.$ Mean $5\frac{2}{8}d.$	$4\frac{2}{8}d.$—$7\frac{6}{8}d.$ Mean $6d.$	167,185	513,326	59·1
Dec. 31	100	2·68	30	9	$3\frac{3}{8}d.$—$6\frac{6}{8}d.$ Mean $5\frac{1}{8}d.$	$3\frac{4}{8}d.$—$7d.$ Mean $5\frac{2}{8}d.$	183,503	528,885	42·8
1886									
Mar. 31	$100\frac{4}{8}$	2·75	29	9	$3\frac{4}{8}d.$—$6\frac{2}{8}d.$ Mean $4\frac{7}{8}d.$	$3\frac{7}{8}d.$—$7\frac{2}{8}d.$ Mean $5\frac{5}{8}d.$	194,033	579,624	36·5
June 30	101	2·50	31	4	$3\frac{5}{8}d.$—$6\frac{4}{8}d.$ Mean $5\frac{1}{8}d.$	$4\frac{6}{8}d.$—$9\frac{1}{8}d.$ Mean $7d.$	176,074	557,673	52·5
Sept. 30	$101\frac{1}{8}$	2·90	31	9	$3\frac{3}{8}d.$—$6\frac{4}{8}d.$ Mean $5d.$	$4\frac{2}{8}l.$—$8\frac{2}{8}d.$ Mean $6\frac{2}{8}d.$	168,225	529,404	61·2
Dec. 31	$101\frac{3}{8}$	4·06	31	4	$3\frac{1}{8}d.$—$6\frac{1}{8}d.$ Mean $4\frac{5}{8}d.$	$3\frac{5}{8}d.$—$7\frac{7}{8}d.$ Mean $5\frac{6}{8}d.$	183,226	536,226	44·6



NOTE.—The price of wheat for week ending 1st January, 1887, was 35s. per quarter.

TABLE XI.—ACREAGE under each Description of CROP, FALLOW, and IRELAND,

[*From Board of*

DESCRIPTION of CROPS and LIVE STOCK.	GREAT BRITAIN.		
	1884.	1885.	1886.
CORN CROPS:—	Acres.	Acres.	Acres.
Wheat	2,677,038	2,478,318	2,285,905
Barley or Bere	2,168,820	2,257,346	2,241,164
Oats	2,915,363	2,940,490	3,081,596
Rye	47,040	50,839	55,926
Beans	446,824	434,653	381,186
Peas	229,645	230,360	214,388
TOTAL CORN CROPS	8,484,730	8,392,006	8,260,165
GREEN CROPS:—			
Potatoes	565,048	548,731	553,961
Turnips and Swedes	2,027,610	2,014,958	2,002,836
Mangold and Beetroot	327,364	354,523	349,295
Carrots and Parsnips	13,587	16,600	16,579
Cabbage, Kohl-rabi, and Rape	146,946	153,079	151,827
Vetches, Lucerne, and any other crop (except clover or grass)	407,148	433,711	405,982
TOTAL GREEN CROPS	3,487,703	3,521,602	3,480,480
OTHER CROPS, GRASS, &c.:—			
Flax	2,247	2,490	3,068
Hops	69,258	71,327	70,127
Bare fallow or uncropped arable land	749,699	560,342	552,898
Clover and artificial and other grasses under rotation	4,381,404	4,654,173	4,689,200
Permanent pasture, meadow, or grass not broken up in rotation (exclusive of heath or mountain land)	15,290,820	15,342,478	15,535,279
LIVE STOCK:—	No.	No.	No.
Cattle	6,269,141	6,597,964	6,646,683
Sheep	26,068,354	26,534,635	25,520,718
Pigs	2,584,391	2,403,380	2,221,475
Total number of horses used for agriculture, unbroken horses, and mares kept solely for breeding	1,414,377	1,408,789	1,425,359

and Grass, and Number of Cattle, Sheep, and Pigs, in Great Britain in 1884-86.

Trade Returns.]

Ireland.			United Kingdom, including the Islands.		
1884.	1885.	1886.	1884.	1885.	1886.
Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
69,008	70,874	68,408	2,750,588	2,553,092	2,357,894
167,346	179,778	181,784	2,346,041	2,447,169	2,432,749
1,347,395	1,327,982	1,323,205	4,276,866	4,282,594	4,418,959
7,152	8,383	10,574	54,234	59,301	66,599
7,756	6,401	6,013	454,839	441,267	387,346
972	739	683	230,696	231,202	215,240
1,599,629	1,594,157	1,590,667	10,113,264	10,014,625	9,878,787
798,942	797,103	799,858	1,373,835	1,355,922	1,364,350
304,031	296,902	299,273	2,342,577	2,322,387	2,312,648
34,512	37,141	37,413	363,031	392,907	387,828
3,139	3,035	3,064	17,062	20,040	20,002
45,346	47,887	45,913	192,397	201,283	197,838
35,443	36,793	35,655	444,958	472,656	443,786
1,221,413	1,218,861	1,221,176	4,733,860	4,765,195	4,726,452
89,197	108,149	127,865	91,444	110,639	130,933
..	..	..	69,259	71,327	70,127
23,560	19,075	17,037	773,542	579,707	570,280
1,962,730	2,032,861	2,094,138			
			32,059,608	32,354,277	32,555,660
10,346,308	10,245,927	10,160,292			
No.	No.	No.	No.	No.	No.
4,112,267	4,228,751	4,184,027	10,422,762	10,868,760	10,872,811
3,243,572	3,477,840	3,367,722	29,376,787	30,086,200	28,955,240
1,306,195	1,269,122	1,263,133	3,906,205	3,686,628	3,497,165
480,846	491,147	492,831	1,904,515	1,909,200	1,927,527

TABLE XII.—NUMBER of BEASTS exhibited and the PRICES realised for them at the CHRISTMAS MARKETS since 1845.

[*From the 'Mark Lane Express.'*]

Year.	Beasts.	Prices.	Year.	Beasts.	Prices.
		s. d. s. d.			s. d. s. d.
1845	5,326	3 6—4 8	1866	7,340	3 8—5 6
1846	4,570	4 0—5 8	1867	8,110	3 4—5 0
1847	4,282	3 4—4 8	1868	5,320	3 4—5 8
1848	5,942	3 4—4 8	1869	6,728	3 6—6 2
1849	5,765	3 4—4 0	1870	6,425	3 6—6 2
1850	6,341	3 0—3 10	1871	6,320	3 10—6 2
1851	6,103	2 8—4 2	1872	7,560	3 8—6 0
1852	6,271	2 8—4 0	1873	6,170	4 4—6 6
1853	7,037	3 2—4 10	1874	6,570	4 4—6 8
1854	6,181	3 6—5 4	1875	7,660	4 6—6 6
1855	7,000	3 8—4 2	1876	7,020	4 4—6 4
1856	6,748	3 4—5 0	1877	7,510	4 6—6 0
1857	6,856	3 4—4 8	1878	6,830	4 6—6 0
1858	6,424	3 4—5 0	1879	5,620	4 0—6 4
1859	7,560	3 6—5 4	1880	7,660	4 0—6 0
1860	7,860	3 4—5 6	1881	8,150	4 0—6 2
1861	8,840	3 4—5 0	1882	7,370	4 6—6 4
1862	8,430	3 4—5 0	1883	5,940	4 0—6 4
1863	10,372	3 6—5 2	1884	5,300	4 0—6 2
1864	7,130	3 8—5 8	1885	7,550	3 6—5 4
1865	7,530	3 4—5 4	1886	6,010	3 6—5 0

TABLE XIII.—AVERAGE PRICES of BRITISH WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER, in each of the TWENTY YEARS 1867–86.

[*From the 'London Gazette.'*]

Year.	Wheat.	Barley.	Oats.	Year.	Wheat.	Barley.	Oats.
	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
1867	64 5	40 0	26 1	1877	56 9	39 8	25 11
1868	63 9	43 0	28 1	1878	46 5	40 2	24 4
1869	48 2	39 5	26 0	1879	43 10	34 0	21 9
1870	46 11	34 7	22 10	1880	44 4	33 1	23 1
1871	56 8	36 2	25 2	1881	45 4	31 11	21 9
1872	57 0	37 4	23 2	1882	45 1	31 2	21 10
1873	58 8	40 5	25 5	1883	41 7	31 10	21 5
1874	55 9	44 11	28 10	1884	35 8	30 8	20 3
1875	45 2	38 5	28 8	1885	32 10	30 1	20 7
1876	46 2	35 2	26 3	1886	31 0	26 7	19 0

TABLE XIV.—CERTAIN ARTICLES of FOREIGN and COLONIAL PRODUCTION IMPORTED in the YEARS 1883–86; and their QUANTITIES.

[*From Board of Trade Returns.*]

	1883.	1884.	1885.	1886.
ANIMALS, Living:				
Oxen, Bulls, and Cows, *number*	427,445	371,010	327,254	284,313
Calves .. .. ,,	47,117	54,492	45,861	35,308
Sheep .. .. ,, / Lambs .. .. ,,	1,115,695	945,043	750,927	1,038,967
Swine and Hogs .. .. ,,	38,863	26,441	16,522	21,352
Bones (burnt or not, or as animal charcoal) .. .. *tons*	73,948	72,640	64,140	57,175
Cotton, Raw .. .. .. *cwts.*	15,367,874	15,505,851	12,586,009	15,187,299
Flax .. .. ,,	1,546,931	1,606,966	1,664,836	1,287,034
Guano .. .. *tons*	73,962	48,284	24,757	68,744
Hemp .. .. *cwts.*	1,440,554	1,334,924	1,446,398	1,213,857
Hops .. .. ,,	125,349	257,374	266,473	153,788
Hides untanned: Dry .. ,,	634,355	646,842	672,878	721,964
,, ,, Wet .. ,,	562,767	572,189	555,114	499,271
Petroleum .. .. *gallons*	70,185,563	52,808,436	73,869,787	71,026,962
Oilseed Cakes .. .. .. *tons*	257,445	269,235	283,052	296,530
Potatoes .. .. *cwts.*	5,149,891	2,444,073	2,300,824	2,709,444
Butter .. .. ,,	2,332,701	2,472,567	1,553,302	1,543,404
Butterine .. .. ,,	*	*	847,263	886,573
Cheese .. .. ,,	1,797,080	1,926,070	1,833,050	1,733,187
Eggs .. .. .. *great hundreds*	7,826,674	8,275,553	8,351,306	8,613,162
Lard .. .. *cwts.*	852,150	698,397	869,842	896,324
Clover Seeds .. .. .. ,,	317,211	290,022	315,803	289,214
Flax-seed and Linseed .. *qrs.*	2,337,867	1,805,535	2,056,263	2,081,283
Rape .. .. ,,	775,358	769,813	544,275	372,613
Sheep and Lambs' Wool .. *lbs.*	494,110,743	519,555,493	501,182,161	591,872,167
Rabbits .. .. *cwts.*	..	..	..	104,226

* Included with "Butter" returns previous to 1885.

TABLE XV.— QUANTITY and VALUE of BUTTER IMPORTED from DENMARK, 1867–86.

[*From Board of Trade Returns.*]

Years.	Quantities.	Computed Real Value.	Years.	Quantities.	Computed Real Value.
	Cwts.	£.		Cwts.	£.
1867	80,589	422,479	1877	210,322	1,347,791
1868	79,437	471,262	1878	242,427	1,517,467
1869	103,613	574,981	1879	281,740	1,673,452
1870	127,013	767,190	1880	300,157	1,777,176
1871	140,851	803,226	1881	279,625	1,691,894
1872	173,574	1,009,322	1882	304,732	1,850,586
1873	201,558	1,203,459	1883	353,584	2,151,730
1874	226,053	1,363,433	1884	335,067	2,008,451
1875	206,171	1,275,870	1885	377,447	2,117,831
1876	205,195	1,311,234	1886	400,556	2,194,905

TABLE XVI.—QUANTITY and VALUE of DEAD MEAT IMPORTED in the 3 YEARS, 1884–6.

[From Board of Trade Returns.]

DEAD MEAT.	QUANTITIES.			VALUES.		
	1884.	1885.	1886.	1884.	1885.	1886.
	Cwts.	Cwts.	Cwts.	£	£	£
BACON:—						
From United States	1,917,243	2,452,076	2,578,167	4,353,797	4,472,262	4,320,613
,, Other Countries	838,661	716,374	677,801	2,430,648	1,955,710	1,821,857
Total	2,755,904	3,168,450	3,255,968	6,784,445	6,427,972	6,142,470
BEEF:—						
Salted .. .. .. From United States ..	203,682	233,031	183,276	403,552	442,739	303,841
,, Other Countries	7,298	7,566	11,874	14,879	15,443	21,649
Total	210,980	240,597	195,150	418,431	458,182	325,490
Fresh .. .. .. From United States ..	809,558	852,210	762,147	2,202,032	2,217,196	1,767,632
,, Other Countries	66,706	49,979	44,634	170,393	125,628	94,454
Total	876,264	902,189	806,781	2,372,425	2,342,824	1,862,086
HAMS:—						
From United States	574,447	782,551	840,841	1,695,280	1,984,471	1,970,994
,, Other Countries	78,579	94,348	102,538	236,211	251,922	265,878
Total	653,026	876,899	943,379	1,931,491	2,236,393	2,236,872
MEAT, Unenumerated:—						
Salted or Fresh .. From United States ..	2,006	2,811	1,655	4,083	5,198	2,947
,, Other Countries	17,512	27,352	40,657	58,990	80,572	109,833
Total	19,518	30,163	42,312	63,073	85,770	112,780
Preserved, otherwise than by Salting .. .. From Australasia ..	127,561	198,279	57,376	309,197	473,364	136,398
,, United States ..	259,632	261,257	292,714	714,115	690,552	662,658
,, Other Countries	61,851	67,191	80,256	368,995	370,261	367,954
Total	449,044	526,727	430,346	1,392,307	1,534,177	1,167,010
MUTTON, FRESH:—						
From Holland	116,182	80,785	52,063	372,146	240,259	130,721
,, Australasia	303,203	336,495	383,317	820,263	833,990	842,409
,, Other Countries	82,989	154,366	216,909	215,901	409,201	431,778
Total	502,374	571,646	652,289	1,408,510	1,483,450	1,404,888
PORK:—						
Salted (not Hams) From United States ..	179,772	221,967	212,720	307,479	332,255	295,086
,, Other Countries ..	98,571	89,944	77,779	159,522	170,661	135,743
Total	278,343	311,911	290,499	467,001	502,916	430,829
Fresh .. .. .. From United States ..	192	889	9	369	1,545	17
,, Other Countries	58,587	69,084	80,644	152,002	181,912	199,346
Total	58,779	69,973	80,653	152,371	183,457	199,363
TOTAL OF DEAD MEAT	5,804,232	6,698,555	6,697,377	14,990,054	15,255,141	13,881,788

TABLE XVII.—QUANTITY and VALUE of BUTTER Imported from the UNITED STATES, BELGIUM, FRANCE and HOLLAND; and of CHEESE Imported from the UNITED STATES and HOLLAND, 1872–86.

[*From Board of Trade Returns.*]

Years.	UNITED STATES.			
	Butter.		Cheese.	
	Quantities.	Computed Real Value.	Quantities.	Computed Real Value.
	Cwts.	£.	Cwts.	£.
1872 ..	45,765	199,679	598,198	1,701,435
1873 ..	43,406	199,639	790,238	2,353,181
1874 ..	36,307	188,769	849,933	2,589,776
1875 ..	40,331	205,900	958,978	2,786,027
1876 ..	118,131	593,122	936,203	2,564,977
1877 ..	188,491	920,561	1,082,844	3,129,829
1878 ..	219,794	998,766	1,345,745	3,306,612
1879 ..	301,054	1,243,075	1,214,959	2,467,651
1880 ..	277,790	1,343,967	1,171,498	3,411,625
1881 ..	174,246	845,125	1,244,419	3,555,702
1882 ..	51,246	250,764	969,502	2,711,259
1883 ..	120,163	562,318	990,963	2,695,704
1884 ..	100,151	447,811	975,362	2,477,981
1885 ..	77,588	314,062	844,361	1,863,958
1886 ..	42,336	160,391	854,770	1,834,370

Years.	BELGIUM.—Butter.		FRANCE.—Butter.	
	Cwts.	£.	Cwts.	£.
1872 ..	74,191	409,555	355,089	1,916,795
1873 ..	76,610	439,501	446,550	2,409,861
1874 ..	76,723	465,517	713,251	3,944,233
1875 ..	79,950	499,028	567,560	3,387,219
1876 ..	65,309	419,209	622,488	3,732,405
1877 ..	58,200	378,435	606,762	3,654,488
1878 ..	80,073	499,889	555,272	3,179,326
1879 ..	63,032	391,166	438,725	2,264,591
1880 ..	53,259	302,993	531,649	2,826,586
1881 ..	50,118	285,606	496,724	2,720,831
1882 ..	54,854	301,675	575,560	3,241,622
1883 ..	50,638	262,193	503,299	2,831,813
1884 ..	60,181	277,466	509,716	2,895,184
1885 ..	40,465*	144,404	450,933	2,578,618
1886 ..	20,002*	69,240	402,620	2,264,001

Years.	HOLLAND.			
	Butter.		Cheese.	
	Cwts.	£.	Cwts.	£.
1872 ..	269,091	1,358,579	329,535	942,537
1873 ..	279,004	1,453,875	336,654	1,013,233
1874 ..	351,605	1,877,755	398,888	1,164,921
1875 ..	357,106	1,917,910	370,123	1,078,594
1876 ..	402,984	2,252,909	330,435	949,413
1877 ..	372,134	2,084,686	341,980	984,855
1878 ..	460,601	2,494,903	355,159	1,018,669
1879 ..	655,377	3,331,149	275,039	743,107
1880 ..	810,509	4,076,399	288,666	810,590
1881 ..	745,536	3,745,885	264,626	747,052
1882 ..	921,182	4,310,830	310,735	866,061
1883 ..	988,266	4,204,121	292,515	824,576
1884 ..	1,112,212	4,982,165	318,996	891,852
1885 ..	307,861	1,661,380	335,973	833,490
1886 ..	359,013	1,775,454	318,596	764,522

* Butterine.

DAIRY PRODUCE, 1886.

The following remarks relating to butter, cheese, and butterine are extracted from 'The Grocer':—

Irish Butter.—The year 1886 will be remarkable in the Irish butter trade as the cheapest year for over a quarter of a century. The butter season opened in the Cork market on Wednesday, April 21, the opening prices being—firsts, 100*s.*; seconds, 77*s.*; thirds, 56*s.* Those were extraordinary low prices for the first day of the season, as will be seen by referring to the opening prices in April of each season for the decade of years ending in 1880.

When it was seen that butter opened so extremely cheap, it was thought that there would be a great reaction, and that as soon as these prices were telegraphed to England and abroad there would be a rush of orders and a large advance. This did not, however, take place; and after a slight temporary advance, lasting only a few days, prices fell even lower, and continued to fall until June 15th, when they stood—firsts, 68*s.*; seconds, 60*s.*; thirds, 55*s.* This was the cheapest day of the season, and the cheapest day for over thirty years back. After this there was a steady but very gradual advance. The highest prices in the following months were—July, firsts, 76*s.*; seconds, 68*s.*; thirds, 61*s.* August, firsts, 86*s.*; seconds, 76*s.*; thirds, 70*s.* September, firsts, 106*s.*; seconds, 92*s.*; thirds, 77*s.* October, firsts, 112*s.*; seconds, 103*s.*; thirds, 92*s.* November, firsts, 117*s.*; seconds, 102*s.*; thirds, 93*s.* It may be observed that even at the advanced prices, butter was as a rule still much below the prices at corresponding periods in former years, and the experience in the Cork market is in this respect representative of all other butter markets.

We are glad to be able to say that there is a marked improvement in the quality of Irish butter, and that this improvement appears to be progressive. What has to be aimed at mostly now, and what we would impress the necessity of on the Cork Butter Market Trustees, is greater uniformity of classification.

Foreign Butter.—Prices for all denominations classed under this head have increased in 1887, as compared with 1886.* Continental butters have scarcely occupied such a prominent place as formerly, prices having been too high when compared with home and Irish produce, and the quality of many of the dairies not being

* See Table of prices on p. XXVIII.

equal to previous seasons. American butter has come very sparingly to our market, Irish butter and Continental butterine having prevented any regular trade being done. The operation of the new tax on oleo in the United States has also had a hurtful influence, as prices have been kept up to figures which precluded importers from acting with freedom or with a reasonable chance of profit.

CHEESE.—While the course of the butter market has followed the expected and conventional lines, the prices of cheese have been of a somewhat surprising description. The new season's make found but a poor reception in consequence of the large stocks of old cheese in the hands of the retail trade, and the general impression was that only a run of very low prices would cause a healthy demand. Buyers were, therefore, inclined to stand aside, as the demand was far from encouraging. In the course of the month of June, although there was nothing in the situation to justify such a proceeding, one or two large English houses began to buy up all the finest cheese in Canada and the United States; and the later makes being curtailed by the severe drought in many parts of the country, prices of American cheese were forced up nearly 20*s.* per cwt. On the other hand, we have been favoured with an exceptionally large and fine make of Scotch cheese, for which there has been a healthy demand at steadily advancing prices. The greater part of the make is now understood to be out of farmers' hands, and a further advance in prices is looked for early in 1887. Dutch cheese have been in full supply, and are at present the best value in the market.

BUTTERINE.—Leaving the natural products of the dairy, we must glance at the artificial, in the form of butterine. This article has met with a steady demand, although not to such an extent as in some previous years, the low prices of the genuine article having interfered with the sale during six months of the year. Prices have also been somewhat unsettled by the action of the United States authorities in imposing a tax on oleo, and both manufacturers and the trade generally have suffered in consequence. The great bulk of the supplies is still drawn from Holland; but the industry of butterine-making is extending somewhat in our midst, as, in addition to the small factories at Liberton and Dunraggit, there has been a new one erected in the neighbourhood of Kilmarnock, and active operations are expected to start in a few weeks. It is still an open question whether the article can be made at a profit in this country, and the result of this latest experiment will be watched with interest.

The Quotations in the following Table are extracted from 'The Grocer.'

TABLE XIX.—PRICES of BUTTER and CHEESE in LONDON during the FIRST WEEK of JANUARY of each of the TEN YEARS, 1878–87.

BUTTER.

	1887.	1886.	1885.	1884.	1883.
BUTTER (per cwt.):—	s. s.	s. s.	s. s.	s. s.	s. s.
Cork 1sts	.. ..	.. ..	.. ..	134 to 143	.. ..
2nds	124 to ..	117 to ..	119 to 136	130 ,, 136	.. ..
3rds	102 ,, ..	75 ,, ..	89 ,, 91	94 ,, ..	115 to ..
4ths	84 ,, ..	50 ,, ..	58 ,, ..	70 ,, ..	89 ,, ..
Normandy	90 ,, 134	80 ,, 144	100 ,, 142	97 ,, 144	110 ,, 150
Dutch	.. ..	.. ..	.. ..	124 ,, 136	134 ,, 144
American	76 ,, 116	60 ,, 112	80 ,, 124	75 ,, 122	.. ..
Bosch, &c.	44 ,, 90	40 ,, 90	45 ,, 90	40 ,, 80	60 ,, 90
	1882.	**1881.**	**1880.**	**1879.**	**1878.**
Cork 1sts	136 to 140	141 to 143	145 to ..	126 to 133	134 to 137
2nds	129 ,, 131	138 ,, 141	143 ,, ..	116 ,, 121	125 ,, 127
3rds	111 ,, 113	104 ,, 107	110 ,, ..	78 ,, 80	99 ,, 101
4ths	82 ,, ..	77 ,, 78	97 ,, ..	.. ..	72 ,, ..
Normandy	110 ,, 150	108 ,, 150	110 ,, 130	75 ,, 136	85 ,, 148
Dutch	125 ,, 144	120 ,, 130	124 ,, 130	116 ,, 120	124 ,, 130
American	60 ,, 122	95 ,, 130	90 ,, 130	50 ,, 110	60 ,, 120
Bosch, &c.	50 ,, 85	65 ,, 84	65 ,, 90	56 ,, 70	56 ,, 74

CHEESE.

	1887.	1886.	1885.	1884.	1883.
CHEESE (per cwt.):—	s. s.	s. s.	s. s.	s. s.	s. s.
English	38 to 78	54 to 78	64 to 85	64 to 86	62 to 82
American	36 ,, 64	34 ,, 54	45 ,, 68	40 ,, 68	46 ,, 70
Gouda	40 ,, 46	50 ,, 54	40 ,, 52	54 ,, 64	54 ,, 62
Edam	50 ,, 54	46 ,, 52	54 ,, 62	61 ,, 66	56 ,, 64
	1882.	**1881.**	**1880.**	**1879.**	**1878.**
English	60 to 82	70 to 90	66 to 86	40 to 84	60 to 90
American	42 ,, 68	56 ,, 72	56 ,, 70	24 ,, 53	54 ,, 70
Gouda	56 ,, 62	60 ,, 68	56 ,, 62	48 ,, 56	56 ,, 64
Edam	57 ,, 64	62 ,, 68	60 ,, 64	46 ,, 56	60 ,, 66

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*Large and Small Holdings: a Comparative View.* By CLARE SEWELL READ, of Honingham Thorpe, Norwich.

SOME of the suggestions which are made at the General Meetings of the Royal Agricultural Society are not very practical, and others are impossible to carry out. The President, with considerate courtesy, promises the member that his suggestion shall be carefully considered by the Council; but it is not often that the proffered advice can be utilized, or the reform carried out in the manner suggested by the member.

At a recent General Meeting * of the Society, a member stated "that it would be both interesting and useful to have a specially prepared report on the products of large and small farms." Upon being asked by the Council to explain more fully his views, the member suggested—

"That the Council of the Royal Agricultural Society be requested to appoint a Commissioner to obtain reliable information, and condense and report same, relating to the relative profit and modes of culture now in practice on large and small holdings, ranging from ten to three hundred acres."

The Council could not see its way to appoint such a Commissioner, but at the same time considered that the matter deserved some special notice, and accordingly I was asked, through the Chairman of the Journal Committee, to prepare a paper upon the subject, with special reference to the products of the two classes of holdings.

The question of large and small farms has occupied a good deal of attention, both in and out of Parliament, during the past few years. Whether large or small farms conduce most

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* December 10th, 1885.

to the welfare of the country will not be the purport of this paper; neither shall I be expected to dilate upon the social and moral advantages which will flow from a larger number of our citizens having a more direct and permanent interest in the soil of this country; but I may be expected to contrast the amount of produce, and the modes of culture usually practised upon these different holdings. I found, however, at the outset of my enquiry, that no practical data, no published statistics and no reliable records were available for such a contrast. Sundry interesting statements as to the yield of certain large farms, a few shadowy figures, and a great many estimates of what could or should be grown upon small farms, might be collected, with now and then a startling record of some * wonderful crop produced upon an allotment. But, as a rule, few farmers keep accurate accounts, and it may be said that small farmers never do. Even the very interesting reports of the Judges of the Royal Agricultural Society's Prize Farms fail to record many £ *s.* *d.* facts, which can serve the purpose of an exact comparison. The most successful competitors do not care to have their balance-sheets made public; and therefore, instead of giving, as I should like, a statistical contrast of the amount and value of the products of the two sorts of holdings, I must content myself with compiling a few remarks, gathered from the opinion and experience of many large and small cultivators, and from the written statements of some able and practical exponents of English and foreign agriculture.

Unless there is some sort of classification of the different sized holdings which prevail in England, no comparison can be attempted. At the various Chambers of Agriculture last year, this subject of large and small farms was thoroughly discussed. In an instructive paper read before the Lincolnshire Chamber, Mr. S. B. L. Druce contended "that a farm of 500 acres and over may be rightly called large; a farm of 100 and

* As an example of the great crops which are sometimes grown upon allotments, Lord Wantage, in an admirable article on "Small Farms" in the 'Fortnightly' of last February, gives the following yield of a Berkshire allotment. Three quarters of an acre in 1885 grew wheat which was sold to the miller for 7*l.*, which, reckoned at 32*s.* per quarter, is 46 bushels per acre. In 1886 there was a crop of barley of 53 bushels per acre. This year winter beans and vetches are planted, which are expected to yield, although the most precarious of crops, 48 bushels per acre. As the wheat-straw was used for thatching the cottage, and the barley-straw sold off, there appears to be no manure used for these cereals. Further on, Lord Wantage records the fact that the rotation of three white-straw crops in succession beggared Norfolk in the last century; but if my county could have produced such yields of grain as this Berkshire allotment, the late Lord Leicester would have had no need to revolutionize the system of agriculture which then prevailed, for with all our modern improvements Norfolk can give no such corn crops as are here recorded.

under, small; and a farm between those two limits, medium-sized." But I fear that I can only afford to treat of two classes, and I must therefore for my purpose include large and medium-sized farms in one division, and all holdings under 100 acres in the other. It is obvious that medium-sized farms, which are sufficiently large to allow the general use of implements and machinery, and to utilize the benefit which arises from classified and concentrated labour, may be rightly termed large, as compared with those smaller holdings where such advantages can rarely be adopted.

There is no doubt that what may be called a large farm in one district may be regarded as small in another; and it is commonly supposed that one county possesses mostly large and another mostly small farms, and that the two classes of holdings do not exist together. As a rule, small farms are common in grass counties, and large ones in arable districts. But in Lincolnshire and Norfolk, for instance, which are the premier grain-producing counties, and which possess more large farms than any county, save Wiltshire, there are no less than 20,000 holdings in the former, and 12,000 in the latter county, under 50 acres. Upon this Mr. Druce observes,

> "That these counties, which are the two pre-eminently agricultural counties of England, contain so large a number of both large and small farms, tends to show that large and small farms can and do exist in large numbers, so to say, side by side."

At the Central Chamber of Agriculture, in March 1886, Mr. Lipscomb, from the West Riding of Yorkshire, proposed and carried these resolutions:—

> "1. Large farms are most suitable where the conformation of the country allows of large, evenly shaped inclosures, and where the soil and climate are specially adapted to the growth of cereals, and the rearing of sheep. 2. Small farms are preferable in hilly or rugged districts, where fields are necessarily small, and where the soil and climate are specially favourable to permanent grass, consequently where a large proportion of pasture prevails, and dairy produce forms a main source of income."

Then followed a third resolution about market gardens and allotments, which was also carried. At the Norfolk Chamber of Agriculture two very similar resolutions had previously been passed, with a third, which stated that "some small farms and separate plots of land, and a proper proportion of allotments, as well as of good cottage gardens, are necessary in every parish." But labourers' allotments and market gardens, except when the latter form a portion of a small farm, must be considered outside the contrast which I have been requested to draw.

With regard to large and small farms, the experience of those who live in the country will uphold the main principles

of the resolution passed by the Central Chamber of Agriculture, and, what is more, facts and figures prove that where small farms are required, and where they are most suitable, there they generally prevail; but they also exist in other districts, where their necessity, from a farming point of view, is not so obvious.

One point in favour of small farms must not be overlooked. In some districts the soil is so rocky and the surface so uneven that cultivation on a large scale is impossible. If such land is to be tilled at all, the holdings must be small, and therefore the produce which results from this kind of tillage is a clear gain to the nation. So after all, the physical formation of a country is the main factor in determining the size of its holdings. Where land is capable of being divided into good-sized arable fields, large farms prevail; but where hills attain a considerable elevation and the land in the valleys is broken and rugged, only small farms can be formed. Small fields in a great measure necessitate small farms, and therefore it may be said, that the division of land in rural districts has generally followed the laws of nature. Near centres of great population, where there is a ready sale for milk, poultry and vegetables, small farms should economically abound. But even near great cities the character of the soil influences the size of the holdings. For instance, Norwich, the biggest town in East Anglia, is environed by light land, and is therefore encompassed with large farms, and it is not until the soil becomes heavier and better that small holdings are to be found in any number.

Taking it for granted that during the last fifty years the tendency has been to amalgamate small holdings, it must also be admitted that this increase of large farms has taken place in those districts which are best adapted to the development of agriculture upon a large scale. There seems no fear that this increase of large farms will continue, but rather that the demand for smaller holdings will be satisfied wherever it exists. This demand may arise from the diminished capital of those large farmers who find that they can no longer cultivate their extensive holdings, but it is much more likely to come from the number of men with small capital, who think they can combine farming with some other trade or calling. It is this class of small cultivators that is generally most successful. The two Royal Agricultural Society's prizes for small farms, awarded at the Norwich Meeting, were both gained by men who partially followed other avocations; and the fact that the first-prize winner adopted steam cultivation, grew his mangolds 3 feet apart, and bought large quantities of artificial manures and feeding-stuffs, shows that he at least had adopted on his small

holding those modern improvements, which are practised upon the best-managed larger farms.

Large Farms.

To attempt a description of the products of large farms, and to record the advantages which the nation has derived from the pioneers of agricultural improvement who have cultivated them, would be to re-write a large portion of the Royal Agricultural Society's 'Journal.' The annual reports of the Judges of the Prize Farms, which have now for many years formed such a prominent and pleasing feature in the records of the Society, contain faithful descriptions of some of the best cultivated large farms in the different districts in which the Royal Shows are held. It will only be necessary to state here that the chief advantages of large farms are, that they have attracted to agriculture men of skill, capital, and enterprise, who have vastly improved the live-stock of the farm, and have availed themselves of mechanical and chemical discoveries, which they have applied to the cultivation and development of the soil. Large farms admit of the employment of all modern machinery and implements, and afford the intelligent and enterprising husbandman a variety of soil and space for producing the greatest amount of food with the least expenditure of labour. That the best cultivators of large holdings have done all this no one can deny, but it is also true, that many large farms are occupied by men with insufficient capital; some by farmers who do not understand their business; and others by men who devote more time to sport and pleasure than they do to the management of their farms. There is also an indictment brought against the large tenant-farmer, that he has spent too much upon himself and his family, and lived in a style that no farm could warrant. Cobbett in his day was horrified to see a bell-pull in a farmer's parlour, and to hear the daughter playing the piano instead of working in the dairy. No doubt, when times went well, the farmer was ready to spend his money freely, and the modern agriculturist indulges in certain luxuries and refinements of which his father never dreamt. But all other classes of society have made a similar advance. The tradesman of olden time lived over his shop, and was behind his counter when his shutters were taken down in the morning. The manufacturer resided close to his mill, and saw his hands enter and leave the premises. Now both have their country residences, and leisurely drive up to business in their broughams. As long as the farm, the shop, and the mill can afford such luxuries, so much the better for the country. Unhappily, the farm can no longer supply any-

thing but the most scanty subsistence, and in some districts even that is impossible in years like the present. This fact, however, furnishes no justification for the statement, which is commonly accepted in towns, that the land system of England, with its large farms, has broken down; that there is no longer room for the three classes of landlord, tenant, and labourer, and that to save agriculture, we must have small holdings and peasant owners. Where similar crops are grown, the small farmer has suffered even more than the large tenant. No one suggests that to cure the stagnation of trade we must break up our large manufactories and return to the hand-loom; but such a suggestion would be as reasonable as the compulsory creation of small holdings as a remedy for agricultural distress. It was gravely asserted at a recent public meeting that it is possible to grow wheat cheaper by the spade than by the plough, although digging an acre of land a fair depth costs quite 4*l.* an acre. There can be no doubt that grain, meat, and wool can be produced more cheaply upon large farms, and that it is only in some dairy produce, in pork, poultry, eggs, vegetables, &c., that the peasant farmer can successfully compete in England with the occupier of large holdings.

In the arable counties, where most of the large farms are found, wretched corn-crops and the low prices of grain for the last twelve years have so gradually lessened the farmer's capital, that his land has not been properly tilled or manured. Where the large farmer grew good roots, the high price of store cattle frequently prevented him from realizing those profits which the good demand for meat should have brought. Those farmers who could breed their own stock of cattle and sheep—but in purely arable counties this is an impossibility—have fared better until the past two years. But now well-bred Irish cattle can be bought much cheaper than any English farmer can rear them, and lambs have been so low in price during the past two summers that they have hardly paid the flock-master the heavy expenses to which he has been put to furnish suitable food in such fitful seasons.

Small Farms.

It is the commonly received opinion that small farmers in these adverse times have held their ground better than their larger and richer brethren. Upon the whole this appears to be correct in many localities. An intelligent writer in the January 'Edinburgh Review' says:—

> "A small farmer content with small profits, depending upon the proceeds of garden and dairy produce, and commanding the labour of his family, may make both ends meet, where a larger capitalist becomes insolvent."

Several causes may be assigned for this survival of the smaller craft when many larger vessels have foundered in the stormy sea of agricultural depression. The small farmer's special produce has not been long severely depreciated. As compared with corn, store-cattle and dairy products have kept up fairly well in value until the last two years, and even now poultry and eggs are not very much lower than usual.* The old saying that "pigs are all gold or copper" has been verified of late, for young pigs off the sow have sold as low as 7*s*., and as high as 15*s*., within a very short period. Even now store-pigs are very dear, and pork, when compared with beef and mutton, is certainly not cheap. Vegetables and fruit have been fearful drugs during the past twelve months, but the small farmer in retailing them to his usual customers in the villages and country towns has not greatly reduced his prices. With his varied produce, he has not felt the pressure of disastrous seasons so keenly. If his corn were not of the best quality, he had the opportunity of turning it to a fairly profitable account through his pigs and poultry. There has been no room for curtailing his extravagances, for the best of all reasons, that he never had any; and he could not very well be more industrious, for he has always worked hard from "morn till dewy eve." He has had the chance of getting his extra labour more cheaply, but, on the other hand, his opportunity of securing a few odd jobs for himself and horses, to fill up their spare time, has been less frequent, and he has not been so well paid. If he has any other trade or calling, he has made the shop help the farm, and the fact that almost all his produce goes straight to the consumer without the intervention of the middle-man, has enabled him to secure that wide margin of profit, which usually exists between wholesale and retail prices, and which is proportionably wider when commodities are cheap than when they are dear.

These general advantages, which have enabled the small farmer to hold his own in counties where pasture-land predominates, have not been fully realized in those districts which are mainly arable. Wherever farmers, and more especially small cultivators, have relied upon their cereals for profit, they must have been more or less disappointed during the last ten years. The waning prosperity of the small farmers in Norfolk was demonstrated to the County Chamber of Agriculture last year by the following figures. The speaker said:—

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* Since the above was written the wholesale price of eggs has fallen to one shilling a score; Norfolk turkeys have been retailed in London at 8*d*. per lb.; and the farmers of the Midlands can now only net 5*d*. per gallon for their summer's milk.—C. S. R.

"I find this unfortunate fact with regard to small farms.

"From 1875, which was about the last prosperous year, to the year 1880, the number of cattle in Norfolk was almost exactly the same—in both these years it was about 108,000. But the men who held small farms under 50 acres had decreased their stock of cattle 2000, which of course is a considerable amount for those small holdings. Then, again, as to sheep. In 1875 there were 728,000 sheep; in 1880 they had been reduced to 638,000—which is a decrease of 90,000—I suppose mainly in consequence of the losses from rot experienced all over the country; in some districts clearing them all off. But I find that there were 12,000, or one-third less sheep kept than formerly on the farms of 50 acres and under, than upon farms of between 500 and 1000 acres, where the numbers, 209,000, remained the same. I think the quantity of live-stock a man keeps upon his farm is not a bad criterion to judge of the state of his prosperity. It is, therefore, from these statistics a lamentable fact to find that the small farmers have suffered even in a larger degree than the bigger farmers.

It is very difficult to state what is the smallest-sized holding a farmer can live upon. The licence that a certain poet took with ancient history would have us believe that in olden times "every rood of land maintained its man." The requirements of the individual must have been singularly small, or the produce of a quarter of an acre something enormous; but the point is, not how little any man will consume, but the smallest acreage he can farm to any advantage. Mr. Kebbel, in his excellent little work on the 'Agricultural Labourer,' contends that 8 or 10 acres are a reward for the best class of labourers, but that 50 or 60 acres are the refuge of the worst class of farmers. To put a labourer into a farm of 10 acres of arable land, would be to present him with a "white elephant," but in a grass country a living is often made off 5 or 6 acres. It is a different matter with ploughed land. The smallest arable farmer, who is not a market gardener, would be unable, if not ashamed, to dig his land. He must use a horse, and a single horse is not a very handy animal upon a farm. If he is to till his land properly, he must keep two. As was said at the meeting above referred to by the same speaker:—

"There is, perhaps, another question you will ask me: What is the size of the smallest farm a man can live upon if he has to get his entire livelihood out of the land? I am not talking of men who are carters, butchers and tradesmen in a village who have a little bit of land; but I am talking of a man who is to be a *bonâ fide* farmer, occupying arable land. I say that the least extent of land that he would require would be 40 acres—from 40 to 50 acres—so that he can keep and employ two horses fairly and profitably. I do not know whether you will accept that; but such is my definition of a small farm—it cannot be less than 40 acres."

But there are so many smaller holdings in Norfolk, that the enquiry will be made, how do these farmers live? The reply will be, that the great majority do not depend upon the land for a living; they follow other callings, or they employ their

own spare time, and that of their horses, in carting or helping their neighbours. There are thousands of small farmers who keep no horse. My own experience is, that the large tenant frequently ploughs the land for his poorer neighbour, charging him only a nominal sum for the use of his horses. But of course the big farmer cannot attend to other people's wants until his own are all supplied; therefore the small farmer's land is often ploughed in wet weather, and his crops sown out of season.

The great demand for small plots of land does not come from labourers, or from real farmers, but from all sorts of village traders, and, in a few instances, from dwellers in towns, who have saved money, and who desire to end their days in the country. Lord Wantage states that men in no less than seventeen different classes, stations and callings had applied to hire or buy land of the "Small Farm and Labourers' Land Company," and the directors were vexed that, with their limited funds, they could not satisfy all the applicants.

One of the causes of the failure of small farmers is said to be the exorbitant rents that some of them are called upon to pay. In a good many instances, the competition for small holdings is so keen, and the acres applicable to such farms are so few, that a very dear rent is exacted, chiefly by small owners and land speculators. But the expense to the landlord of equipping a number of small farms, with the necessary buildings, roads, approaches, fences, &c., is not often fully realized. If a fair percentage upon the capital were charged, that would probably double the rent of the naked land, and the annual repairs which are necessary upon a small farm are twice, and possibly four times as costly as those upon adjacent large holdings. There is the further difficulty of securing a suitable position for small farms. Upon this point Mr. W. C. Little recently observed:—

"Now there is one part of that subject on which I think there is a very great and general misapprehension, and that is as to the supposed extravagant rents which are charged for small holdings. Few people who have not gone into the question realize to what an extent the rent of land is a question of position and not of fertility. Naturally a labourer who wants a small holding wants it near a road and near a village, and easily cultivated, applicable to almost any purpose, and it is worth a rent exceptionally large compared with the ordinary agricultural land."

And Mr. Little then forcibly illustrates this argument:—

"A remarkable instance of the difference in value which arises from mere position of land occurred in my own neighbourhood only the other day. Some mortgagees put up some estates for sale. They lay in the next parish to that in which I live. There was some land near to the town, which sold at 500*l.* an acre. It is only a little town. You may call it a village, perhaps,

it having 5000 inhabitants. There was land equally good for every agricultural purpose, which I will engage to say was capable of growing any sort of crop as well and at little more cost, which was offered and fetched only 18*l.* an acre. The whole of that difference being due to the position of the lands that were sold."

When labour was very cheap and employment was scarce, the labourer, who had saved enough to take a small plot of land, soon found that he could make more of his bone and sinew by working for himself. Now the labourer gives his employer less skill and shorter hours, and yet receives more wages; if he can find employment (and *good* labourers are scarcer than ever), he is certainly better off than the vast majority of small farmers. A thoughtful writer, who has made this subject his special study, says: "When the agricultural labourer becomes a small farmer, he often exchanges moderate hours and regular wages for incessant toil and a meagre competency." But yet the small occupier has this pull over his big neighbour. By "doing the work of two labourers and living at the expense of one," and with the assistance of his wife and children, he now saves that labour which costs the large farmer 50 per cent. more than it did 50 years ago. Yet, after all, if the value of the article produced will not pay for the cost of its production, the small as well as the large farmer must soon cease to produce that article; and there is little or nothing now grown upon the cultivated land of England which leaves a fair profit at present prices. One after another of the products of the farm have ceased to be remunerative, while many of them are grown at a considerable loss. It is little use telling farmers to alter their course of cropping, for no sooner do they substitute one produce for another than it becomes more depressed than the original crop. For instance: Norfolk farmers were told to leave off growing wheat, and turn their attention more to meat and barley. Barley that will make excellent public-house beer now sells as low as 21*s.* per quarter. Beef is now lower than it has been since 1851, and if sheep were not short in numbers, and keep very plentiful, mutton would be equally depressed. The smaller farmer is advised to grow fruit, but the prospect last summer of acres of gooseberry and currant bushes, and hundreds of plum-trees, all laden with fruit that would not pay for gathering, was not encouraging. Another point is that fruit-farming yields the most precarious income of any class of husbandry. First of all, it requires a considerable amount of capital to start with, for fruit-trees, and even bushes, do not grow crops in their infancy. Then there may be an enormous yield when the markets are glutted, and the prices, as those of last year, become ruinously low, or there may be absolutely no fruit.

The small occupier cannot stand against these losses; he may have to put up with small profits, but he must have certain, if not quick returns. Even in the growth of common vegetables, those that come earliest to market may give a good profit, while those that are only a few days late are sold at a loss. The means of rapid and extended transit enable the small farmer of the present day to send his perishable commodities to market from greater distances than in past years; but if it be true that the carriage of eggs to the Metropolis costs as much from the West of England as it does from Italy, and that poultry can be sent as cheaply from the South of France as from Wales, it follows that the foreign peasant, with his sunnier skies and drier climate, has obtained still greater advantages from steam communication.

Railways have been the means of wonderfully developing the milk trade, but the expenses of carriage and of distribution are so considerable, that some farmers only netted 6*d.* per gallon for their milk during the summer of last year. The man who keeps a single cow can never contract for a regular supply of milk. Being bound to furnish a certain quantity for a given time is one great drawback to the profit of the large dairy farmer. The little man who can retail his milk to his neighbours may do so with advantage, but more generally the produce of a very small dairy is turned into butter, and in rare instances into cream-cheese. So taking dairy produce all round, small farms have no advantage over large ones, though in its distribution the wife of the small farmer, if a good market-woman, can generally make a considerable profit.

It is in pigs and poultry, and now and then in calf-rearing, that the live-stock advantages of *la petite culture* are most prominent. Pigs delight in warm food, comfortable beds, and absence of overcrowding. All this they more generally receive from the small than the large farmer. Poultry always do best in small lots. Gigantic poultry establishments, however scientifically managed, invariably come to grief. Six hens will generally lay more eggs per fowl than a dozen, and a dozen than a score.

The necessity of dividing poultry into small lots is now generally felt where great quantities are kept. Instead of all the fowls on a good-sized farm being congregated around the homestead, wooden houses upon wheels are constructed, in which 15 or 20 hens lay their eggs and roost. These houses are moved to various parts of the farm, and the fowls, by having access to fresh ground, find plenty of insects, and after harvest eat a quantity of corn that would otherwise be wasted. Fowls by this means are not only fed more cheaply, but they lay more

eggs, are more healthy and do ever so much better than when they are kept in large lots on the same ground.

It is in eggs rather than in fowl-rearing that most money is made from poultry, and in eggs the common cross-bred fowl of the little farmer will beat the prize-winners of the most improved breeds. Nothing pays so well for minute care and attention as poultry, and this the large farmer's wife cannot or will not give. The barn-door fowl of the large holding is classed with the store-pigs of the straw-yard; both are valued for consuming grain and offal that would otherwise be lost. If their profit is small, their cost of maintenance is still less. Constant watchfulness, warm roosting, and regular feeding, combined with an intelligent knowledge of the management of the different kinds of fowls, pay well on most farms. This costs the large farmer money, but it is "all in the day's work" on the small farm; and that day's work, however long and tedious, is seldom credited with much cash. So after all, it is a question of time and labour; and when the small farmer charges nothing for his wife's time, and is satisfied with very modest earnings for his own labour, he can certainly produce these small articles at a cheaper rate than the occupier of larger holdings. No doubt his success in providing these small articles is not due to superiority of quality or great increase of produce, but rather to the slight remuneration which the little farmer is content to receive for his labour and care in the production and distribution of his goods.

AREA OF FARMS.

England.

In February of the present year Major Craigie read before the Royal Statistical Society an elaborate paper on "The Size and Distribution of Agricultural Holdings in England and Abroad." It gives a most complete, detailed, and accurate account of the sizes of farms in England and on the Continent; and a vast amount of labour, time, and research must have been spent upon its compilation. The question of England being the country of large holdings is thus disposed of:—

"At the outset of this enquiry, we see that in this United Kingdom—a country of large farmers as we are often told it is—a fourth of our 'farmers' are petty occupiers of no more than 5 acres of land, and those who farm less than 50 acres constitute nearly four-fifths of the entire body.

"In England alone the 5-acre men and those below them make up 30 per cent., and the class below 50 acres 71 per cent. of the whole, while barely one holding in every hundred exceeds the dimensions of a 500-acre farm."

It appears that in 1875 the average size of English farms was 57 acres; it is now 60. In Norfolk the average size of a farm in 1875 was given as 56 acres; it is now 66½, or, speaking roughly, it is an increase of 10 acres in ten years. In the Eastern, North-Eastern, South-Eastern, and East Midland Counties of England the average holding is a trifle under 70 acres; in the West Midland and South-Western it is about 58½ acres; and in the Northern and North-Western, 48¾ acres.

This shows that the smallest holdings are situated where the agricultural population forms the smallest part of the community, and it points to the conditions under which small farmers can alone compete in this country on equal terms with large farms, viz., closeness to markets and the ready sale of garden and special products, and the possession of some other trade.

Major Craigie mentions two rather singular facts. During this long spell of agricultural depression there has been a large migration of country labourers into the towns; but it is not always the counties which have the fewest small holdings that have lost most labourers. The other point recorded is that wages are cheapest in counties where there are most allotments. This is only natural, for labourers who have cheap and comfortable cottages and good allotments are not often tempted to migrate for higher wages. Another reason may be that, where good wages are earned, the labourer cannot afford the time to cultivate much land: the produce does not pay him.

I do not wish to quote many statistics, but the following table, extracted from the same paper, will show at a glance into what sort of holdings the face of old England is now divided:—

Holdings.	Acres.	Percentage of Area.
¼ of an acre and under 1 acre	9,988	0·04
1 acre to 5 acres	286,526	1·15
5 acres to 20 "	1,219,663	4·89
20 " 50 "	2,042,370	8·60
50 " 100 "	3,285,350	13·19
100 " 300 "	10,285,988	41·32
300 " 500 "	4,328,722	17·39
500 " 1000 "	2,697,794	10·83
Above 1000 acres	735,138	2·95
	24,891,539	—

"It will be noted from this table that the greatest part of the surface is occupied by the medium-sized holdings of England. The area cut up into small holdings under 50 acres, and the area devoted to farms of 500 acres and upwards, are curiously enough nearly equal, and roughly the surface of England may be thus mapped out:—

"In 294,729 holdings under 50 acres, there are 3,559,000 acres.

"In 115,525 holdings between 50 and 500 acres, there are 17,899,000 acres.

"In 4696 holdings over 500 acres, there are 3,434,000 acres."

Major Craigie then gives some curious instances of the large number of small landowners in different parts of England. He mentions a parish in the Isle of Ely which contains 11,000 acres and 1800 inhabitants, and which has 304 holdings owned by 179 proprietors, of whom 68 occupy their own land. Temple Bolsall, in Warwickshire, has 4815 acres, with a population of 1157, and has 30 owners farming their own estates. In the two parishes of Epworth and Owston, in the Isle of Axholme, Lincolnshire, there are in the former parish 145, and in the latter 112 owners farming holdings under 20 acres; and in the east of that county there are in Leake 156 owners, in Wrangle 103, in Friskney 94, and in Hogsthorpe 53, all farming their own estates of 20 acres and under.

Many like instances might be quoted of the great number of small landowners in many parishes in Norfolk and other counties, and it is a common remark that where they exist the land is badly farmed and the labourers are only casually employed.

Mr. S. B. L. Druce reported to the Royal Commission on Agriculture upon the whole of the Eastern district of England, which included Lincolnshire, and his general conclusion as to whether the small men did or did not stand the bad times better than their bigger neighbours is thus summed up in that report:—

"It seemed to me they had felt them more; they had not indeed lost so much money (proportionately, I mean), because they had proportionately less to lose, but they felt the pinch more; they had nothing to fall back upon, nor was their credit good enough to enable them to borrow money to tide over their difficulties. Living as most of them appeared to do from hand to mouth, and depending solely on the crops of the current year to pay that year's expenses, when their crops failed, as they did in 1879 and 1880, they were unable to meet their expenses, and so were placed in a very serious plight, and had to trust to the forbearance of their creditors, mortgagees, and others to keep on their holdings. The large farmers, on the other hand, though their losses had without doubt been very heavy, were not placed in so serious a plight; their credit was not gone, they had not exhausted it in the purchase of their farms, as the small freeholders had, and they had their stock to fall back upon when their crops had failed. Then too their losses had been in many cases partially shared by their landlords, who, as a rule, had made remissions of rent, but the mortgagees of the small freeholders had made no remissions."

And Major Craigie, after having elaborated his figures so as to embrace the live-stock kept per acre and the labourers employed upon the farms, and after having given the size of different holdings in every county of England, thus concludes:—

"That there are plenty of examples of small cultures in England to guide us if we choose to look around, and base our inquiry on general results, not on isolated instances, is the main conclusion I draw from the English figures. Scores of successful instances of small farming by suitable men, with suitable wives, on suitable soils and in suitable places, all of us can recall: but scores too, if not hundreds of cases, without looking beyond our English shores, may be marshalled where the small farmer has lived a more miserable existence than the far more lightly worked and better remunerated labourer. We are not called on to adopt without qualification the dictum from the times of Arthur Young: 'Deduct from agriculture all the practice that has made it flourishing, and you have precisely the management of small farms.' Neither on the other hand can those who use figures with some regard to the proprieties of statistical method, jump to the opposite conclusion, founded no doubt on generalization from some isolated and perhaps garden plot experiment, that 'a million labourers working for themselves would produce far more wheat than the same land does when cultivated by the most scientific farmers.'"

Foreign Countries.

It may be well to glance for a short time at the number and the condition of the small owners and occupiers of land in some other civilized countries of the world.

It is hardly fair to compare the small English farmer with the cultivator of land in North America. In the United States, where the laws are expressly directed against the aggregation of land in large estates, we find there are more tenant-farmers than in any other country.

The idea that farms in Canada and the United States of America do not exceed 160 acres is quite erroneous. Small farms abound almost everywhere in the Eastern States, and the larger holdings are to be found in the far West. Many of these vast estates are well farmed, if continuous wheat-cropping without manure can rightly be termed farming. With the organization of horse and manual labour, and the application of every kind of labour-saving implements and machinery, combined with the fertility of the virgin soil, the prairie farmers beyond the Mississippi have driven wheat-growing from the New England States. The fierce competition of these Western farmers has hurt their smaller brethren in the East almost as much as it has helped to ruin the English farmer. The small farmer of the older States of America has therefore to devote his energies to the production of those perishable articles which find a ready market in the great cities of the Atlantic seaboard: but even in that "land of promise" he has to work very diligently to make a competency, and at all times of the year he has to labour harder, and in the summer for much longer hours than the English labourer.

During the last few years the financial position of the large

wheat-growers of Dakota and the Western States has not been satisfactory. Even they have felt the keen competition of Indian wheat; they can no more make a profit by sending wheat to Liverpool at 30*s.* per quarter than the English farmer can grow it at that price.

The new settler in America, whether in the States or across the Dominion border in Manitoba, generally goes as far West as he can to claim his "homestead" of 160 acres. No sooner does he acquire this right than he often proceeds to mortgage his estate to enable him to build his shanty, stable, &c. For the money so advanced he has to pay 8 or 10 per cent. in the best settled parts, and should he go further West, he is charged 10 and 12 per cent. Manual labour is so dear, and the summer so short, that he must have the aid of those costly machines which the small farmer rarely uses in the old country. For these he pays upon "the three-years'-system," and has to give a "chattel mortgage" on his crops to the implement maker, his spare capital being required to buy horses, carts, &c., and to make provision for the maintenance of himself and family until the first harvest is reaped, which is rarely less than 18 months after his arrival. In good times it is an uphill fight, but when money is made, it is *saved.* With poor crops and low prices, the small farmer in Western America is possibly no better off financially than the bulk of English farmers, and of home comforts he has certainly much less.

Coming now nearer our own shores, the position of the peasant farmer on the Continent of Europe, and his capacity to cope with the larger cultivator, may afford a better contrast than the farmers on the other side of the Atlantic. The land which the peasant occupies in France is generally his own. The number of landowners is about 8,000,000; but they do not show signs of great prosperity when it is stated "that more than 3,000,000 are exempt from taxation by reason of their poverty." Mr. H. M. Jenkins told the Duke of Richmond's Commission that the Irish "gombeen man" exists in France and Belgium; and in the January number of the 'Edinburgh Review' we read that the peasant borrows money at usurer's interest from the "local Rigore," and that small proprietors owe two, three, and four years' interest, and are "mortgaged up to the hilt." It appears that 1,815,000 holdings under 12½ acres do not cover more than 12,000,000 acres; those from 12½ to 100 acres embrace 44,000,000 acres, leaving 27,000,000 acres for holdings over 100 acres; the total acreage of France being about 83,000,000 acres. In France, farms over 100 acres cover one-third, and in England three-fourths of the cultivated land. In France, about 94 per cent. of the holdings are under 50 acres,

and in England 92 per cent.; a proportion so similar that, were it not for the largely non-agricultural character of many of the English properties, it would excite the wonderment of many.

The late Secretary of the Royal Agricultural Society, in his exhaustive reports on the farming of France, Belgium, Holland and Denmark,* stated that the good cultivation of small parcels of land was impossible, and that in parts of France there was not a strip of holding above 2 or 3 acres in extent. He mentions one field of 50 acres owned by 19 proprietors and farmed by one tenant, and a commune, 2000 acres in extent, is recorded as having 270 owners, and 5348 "parcels" of land. The nuisance of the numerous different allotments, which were so common in our "open fields" throughout England, prevented the land from being properly farmed. Inclosures and consolidations altered the whole face of the country; but such improvements seem impossible in France.

It appears necessary to repeat that Mr. Jenkins's report established the fact that our acreage production is much greater than that of the Continent, the nearest approach to English crops being the rich alluvial soil of Holland. Two English acres grow as much food as three French, but the latter certainly utilize their produce much better. The French peasant makes from 20*l.* to 25*l.* a year out of the fresh butter from a single cow (although the cow is often worked on the land), and sitting hens lay on an average 80 eggs a year, which is much in excess of our poultry, though possibly climate has much to do with this prolific yield of eggs. Large farms in France produce more than small holdings, and this is general throughout the Continent, save in East Flanders. Sheep-farming decreases generally, but especially in France. The whole of Mr. Jenkins's remarks confirm the old story told by M. Lavergne more than 30 years ago, that the British Isles produced more food for cattle than the whole of France with twice the extent, and that England produces four times as much meat, milk and wool as France, and this is not attributable to better soil and climate, but to superior cultivation.

Before leaving France it may be well to note the most recent testimony upon the condition of the peasantry. In the 'Edinburgh Review' already quoted we are told that:—

"The French peasant is worse housed and worse fed than the English labourer. His cottage is generally a single room with a mud-floor, in which he and his family and his live-stock live, eat, sleep, work, and die. . . .

"From morn till night his toil is excessive and prolonged, female labour is

* Reports to the Royal Commission on Agriculture, 1881 and 1882.

the rule, and children are continually employed. Small farmers are the first in the barn in the winter, and the first in the field in the summer, and the last to leave their work."

In Germany there are numberless small holdings, but those of the lowest grade, under 12½ acres, are generally held by occupiers who follow some other pursuit. Farms between 25 and 50 acres cover about half the area of Germany. Hungary is the country of large farms, half the land being farmed by the owners on a grand scale, some estates being over 200,000 acres. The management is business-like and complete, but oxen are sometimes worked until they are 12 or 14 years old, and sheep shorn until 8 or 10 years old. Professor Wrightson, in reporting upon the agriculture of the Austro-Hungarian Empire,* mentioned one estate, Tot-Megyer, which contained nearly 23,000 acres. He said that half of this vast area is arable land, and that it grows good crops of wheat, rye, maize, sugar-beet, mangolds and forage crops. Upon this, Major Craigie observes in his recent paper read before the Royal Statistical Society,

"That this plan of large landlord farming may well claim a place by the side of samples of peasant proprietors' work is apparent, when it appears that the wheat yield equals 24 bushels to our acre, while the general average yield of the country is put by good authorities at half this figure. The yield of barley at Tot-Megyer is something approaching our own at or about 33 bushels per acre against an average of 16 to 20. Oats yield 50 bushels against a similar small general average. The live-stock on such a farm as that embraced 346 horses, of which 150 were foals, 787 head of cattle, of which 400 were kept for the plough, and a flock of over 21,000 sheep."

In Holland there are more often found our three divisions of landlord, tenant, and labourer. Upon the small holdings the number of owners who farm their own land number as 3 to 2: upon estates of over 50 acres there is a more equal division between yeomen and tenant farmers. Mr. Jenkins said "that numbers of peasant proprietors, whether dairy farmers of North or South Holland, or the arable farmers of light land, are overwhelmed with mortgages, very many forced sales occurring annually."

In Belgium the subdivision of property has made great progress, there being now nearly double the number of proprietors than there were 50 years ago. All this increase seems to be in estates under 7½ acres, and more than three-fourths of it is among plots below an acre. Major Craigie, in his valuable statistical paper already referred to, says:—

"The fallacy which used to be often heard, that Belgium with her relatively large number of stock feeds more beasts and therefore produces

* 'Journal,' R. A. S. E., 1874, vol. x. p. 305 *et seq.*

more meat than England, was pretty well disposed of by Mr. Jenkins in a paper read before the London Farmers' Club in 1872, and it was then shown, as the most recent trade statistics continue to show is still the case, that Belgium is far from being a self-supporting country. I find there was actually a net increase of 91,000 cattle imported in 1880; and if there are to be found on Belgian acres 25 head of horned stock per hundred persons, and 47 per 100 hectares of surface, these are very largely draught animals, and their weight much inferior to our own. Their sheep, always a small supply, have diminished from 586,000 to 365,000 concurrently with the growth of Belgian *petite culture.* The production of meat per acre in Belgium is estimated not to exceed 40 lbs. per head of the population, against a native production of 83 lbs. per head in this country. Practically, as the report submitted to our Royal Agricultural Society in 1870* showed, the small farmer produces no meat but pork, and consumes none other himself.

"Fifty years ago or more the agriculture of Flanders was deemed the most productive and advanced in Europe; but while English agriculture has made enormous strides in the interval, that of Flanders has remained where it was. Belgium, like England, like Germany and France, is suffering deeply from agricultural depression, and the small proprietors, hardest hit of all, are calling for protective duties."

Italian agriculture is very varied; large and small farms stand in close contiguity, and there are between 4 and 5 million owners. Agricultural depression is extreme in Italy and taxation is very heavy, direct taxation alone taking about one-third of the produce. Small holdings of 2 or 3 acres, planted with vines, figs and olives, exist in Calabria, Ravenna and Ancona, but the return is often small, and these peasant owners sometimes want bread. In some parts the curious system prevails of ancient associations farming land under old charters, in one instance, 170 families in a group own 19,000 acres.

In Sweden, according to Mr. James Howard's interesting little book on Continental farming,† the surface is pretty equally divided between large and small farmers. The smallest farm upon which a man can solely maintain himself, his wife and family, is 40 acres, with an outrun of 50 to 100 acres in rough pasture or forest. Half the farm labourers are women, while in Italy the "female agriculturists" are 55 to every 100 males. Small plots of ground are let to labourers who pay rent in labour one or two working days a week, and extra work in harvest by women. A similar plan exists in other parts of Europe, where serfs continue to be bound to the soil, receiving land for their labour services, and the "métayer" system is also common in some districts, the tenant paying rent with certain proportions of the produce of his farm.

Mr. Jenkins reported more favourably on the agriculture of Denmark than that of any other country in Europe. That little

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* 'Journal,' R. A. S. E., 1870, vol. VI. p. 1 *et seq.*

† 'Continental Farming and Peasantry,' by James Howard. 1870.

kingdom had not been invaded by agricultural depression when he reported to the Commission. No doubt the fall in the price of beef and butter has now been felt by the Danish farmers. The products of the dairy in Denmark are more carefully handled and more scientifically treated than with us, but it appeared that the large farms, rather than the smaller ones, produced the best articles, and made the best returns. The abolition of the law of distress in Denmark has caused fore-rents or security to be given by tenants, and consequently labourers are hindered from becoming small farmers. Although the hours of labour are from 5 to 7, the Danish labourer earns less than the English, a single man's wages, with board and lodging, being 5*l.* a year. He eats little meat, except bacon, but he sometimes saves money to buy his cottage or a little bit of land. The cost of the transfer of land in Denmark is 2 or 3 per cent.; in France and Belgium, where the Government stamps are heavy, it ranges from 7 to 10 per cent.

After a long and minute examination by the Royal Commissioners upon all branches of foreign farming, Mr. Jenkins gives his final answer thus:—

"The system of agriculture pursued in this country (England) produces more food than the system of any other country he had visited, and he should be very sorry to see any system of foreign agriculture applied to this country."

And my friend, Major Craigie, sums up his admirable paper on the size of "Agricultural Holdings in England and Abroad" in these words:—

"My main conclusion must be that England has plenty of experience of small farming now. There may be room for more in special situations where dairying, market-gardening, and fruit-growing can be carried on; but no data I have drawn from foreign records can be taken as offering any condemnation of a system of agriculture which, judged by its results, is, in spite of all our present drawbacks, second to none in its aggregate productive capacity."

The member of the Royal Agricultural Society who suggested that the attention of the Society should be specially directed to this question of "Large and Small Farms," is still more emphatic in his condemnation of "la petite culture," for he says:—

"Special details on the subject of small holdings, whether from France, from Belgium, or from Italy, all conclusively point to an amount of personal misery and suffering amongst the cultivators, that is most appalling to peruse; and it ought to become one of the highest functions of a Society like ours to warn the native population against following examples that experience shows ultimately bring upon the cultivators of these small holdings such dreadful privations and such persistent personal miseries."

The main object of improved agriculture is to raise the greatest possible amount of produce from the soil with the least cost of labour. It seems to be the desire of some countries to make the land carry as many human beings as possible, without any regard to their prosperity and comfort.

The following Table, which is condensed from Major Craigie's statistical paper, gives a concise comparison of the agricultural products of England and the Continent:—

	Population.	Inhabitants per sq. mile.	Cows per sq. mile.	Other Cattle per sq. mile.	Sheep per sq. mile.	Yield per Acre		
						of Wheat.	of Barley.	of Potatoes.
	millions.	No.	No.	No.	No.	bushels.	bushels.	bushels.
England	25	483	36	57	322	28·9	34·4	252
Austria	22	192	36	38	33	15·7	13·5	109
Hungary	16	126	15	24	85	11·5	13·6	38
France	38	184	31	32	110	15·3	18·7	114
Germany	45	217	43	32	92	18·9	..	..
Holland	4	315	77	37	56	21·4	41·9	173
Belgium	5½	487	70	51	32	25·9	34·9	..
Sweden	4¾	27	8	4	8	..	..	124
Italy	28	257	16	21	77	11·9	..	..

Correspondence.

Living as I do in an arable county, and being more intimately acquainted with the farming of East Anglia than with the agriculture of other districts, I thought that some advantages might appertain to small holdings in other counties, which I fail to discover in Norfolk. I felt certain that wherever grass predominated, there small holdings abounded, and I knew that there were sundry farm products that could be grown in small quantities quite as economically as on more extensive holdings. I therefore wrote to some friends in different parts of England, asking them to furnish me with some of the advantages of small farms over larger ones. In no one instance have they reported in favour of the greater productiveness of small farms. Tradesmen occupying plots of land often manure them heavily, and grow greater crops than the ordinary farmer, but the small farmer, who has no other calling, is not much addicted to the use of oil-cakes, nor given to spend much money in artificial manures.

Selecting some of my correspondence as typical of the rest, I will begin with the most favourable of all the reports. It comes, as might naturally be supposed, from Devonshire, and is kindly furnished to me by Mr. J. B. Spearing, who many years

ago at Moulsford, and more recently as agent to the Maristow Estate, must be well known to many members of the Royal Agricultural Society.

Remarks on the Contrast of the Products of Large and Small Farms in the vicinity of Plymouth.

"The advantages which the small farmers in this locality possess over the large ones are, that their simple mode of living and their industrious habits enable them to do better than the large farmers, who, having to pay for everything which they have done, are being ruined by the very low prices of all kinds of stock and produce, and increased price of labour.

"The small farmer, with his wife and children in most instances, not only milks and feeds the cows, rears the calves, looks after the poultry and the pigs, but the wife, after also attending to her dairy and butter making, takes all the produce she can spare from the dairy, poultry, all kinds of vegetables, fruit and even flowers to market herself; and by these means generally provides the rent by the time it is due, besides occasionally selling the primest joints of pork and black and white puddings, being content to live themselves on that which is not so easily converted into money.

"The farmer himself with his eldest boys works harder, and many more hours than a paid labourer does now-a-days, and always has a watchful eye on all the live stock; he employs as little outside labour as he can possibly do without; he frequently hires his machines and other implements from his neighbours on the larger farms.

"The small farmer grows but little more corn than he can profitably consume himself, but he generally manages to sell sufficient to repurchase his seed corn, consequently the low price of corn has but little affected him, and he has been comparatively a thriving man until the last two years, during which time the great depreciation in the price of all live stock has so reduced him and his capital, that he can no longer pay the rent which he formerly did.

"For my own part, I do not take this gloomy view of the aspect of things, for if the small farmer will only adapt himself to the altered circumstances of affairs, he might still hold his own very favourably against the large farmer.

"Since my retirement from the more active duties on the Maristow Estate, I have had the opportunity and leisure to discuss this matter over very freely with the farmers, and have inspected several small farms in this neighbourhood.

"I will give one instance, which I think fairly represents their system and management of live stock.

"In the summer of last year I went over a farm, not exceeding 100 acres, on which I found about 60 head of cattle of different ages, besides 6 dairy cows and about 150 sheep. The cattle comprised about 15 beasts over three years old, 15 over two years, 14 yearlings and 16 or 17 rearing calves.

"I first came upon the 15 old beasts, and afterwards the yearlings and two-year-olds. On asking the farmer why he was keeping these old cattle, he replied that the price he had been offered for them was so miserably low that he could not make up his mind to sell them. I then enquired if they were not worth the same or more money 12 months ago, and he admitted that they were. I said: 'By keeping them, and giving them all the best roots and grass on the farm, you have been starving all your younger cattle.' If he had sold them in the autumn of last year at whatever price he could have made of them, and given the food which they had since consumed to the young stock, the 30 yearlings and two-year-olds would have been worth more money than the whole 45 feeding cattle, and by giving them a little

cotton-cake with the grass (which in Devonshire is generally in too succulent a state to make cattle thrive well upon it) he would not only have improved the condition of the pasture to nearly or quite the extent of his outlay on cake, but he would have found in the autumn a ready sale for his two-year-old cattle, if not with the butcher, at least with those who would soon have made them fit for the slaughter-house.

"The farmer could not deny these facts, but he shrugged his shoulders at the idea of putting his hand into his pocket to purchase cake.

"The sheep were all on the moor, as many of the farmers have a run on the commons. They comprised about 60 breeding ewes, 50 hoggets, and 40 old wethers. I told him that the old sheep ought to be sold, and never brought home again to the farm to help starve the others, and that the hoggets not required for breeding ought not to have been put on the moor, but fed and got rid of at 12 or 14 months old, and that the present price of wool did not justify his keeping old sheep on the old theory that the wool paid for their keep.

"Lastly, I viewed the dairy, poultry and pigs, which were all fairly and judiciously managed, and departed by remarking to the farmer, that when he adopted the same principle which he successfully carried out in these three last departments, by turning everything into money in the shortest possible time, and getting rid of his cattle at 2 or 2½ years old, and his sheep at 12 or 14 months old, he might then be able to compete with the foreigner; but at present, if he had his farm rent free, he would not be able to make a decent living."

Sir Massey Lopes adds :—

"I believe the great difference is, that in this country the small farmer is more frugal and more industrious, his family doing all the work of the farm. Again, it is mixed husbandry; they do not put all their eggs into one basket. Their staple commodity is rearing stock; they seldom feed any. There are generally common rights attached to each farm. In letting a moorland farm I look more to a working family, rather than to capital. I am quite certain, if I had taken the advice of my friends 30 years ago, and concentrated my farms, I should have them all now on my hands."

This is a good example of the old legal adage, "Friendly advice costs nothing and is worth nothing." To suggest large farms in a hilly country with a thin soil and a damp climate is about as wise as recommending Norfolk to be cut up into plots of "three acres and a cow."

From Devonshire to Northumberland and Durham is a long jump, but Mr. Thomas Bell, the indefatigable Secretary of the Newcastle Farmers' Club, favours me with the following pertinent remarks :—

"I really do not see that I can help you in saying anything in favour of small farms as compared with large ones. I observe that a small farmer who keeps clear of the plough generally does well; but whenever arable land is touched, his life appears to me to be one of toil and penury. A number of the miners and labourers around here hold plots of grass land of about 2 to 4 acres, attached to their houses; these I think have been a great boon to the men and perhaps more so to their families. These people keep a cow or two, run a calf, keep poultry and pigs, leaving the man free to follow his wage-earning employment; but then these men are not farmers. The small farmer

who keeps, say, two horses, and goes in for corn and roots, labours, in my opinion, under many disadvantages. The family of the small farmer is usually well schooled in habits of frugality, thrift and application to hard labour, and is therefore a class of the community, which it is desirable to increase, but as to any advantages which accrue to the country by increased production, I think it is the other way. If the labour of the farmer and his family is debited to the farm, as it ought to be in all cases, it will indeed generally be found to be cheap labour."

Coming now to the Midlands, my friend Mr. Albert Pell puts forth two prominent advantages that small farmers possess over large ones: "1. Contentment; 2. Ability to pay rent, and that hardly ever a low one." It is pleasant to find anywhere a farmer who does not grumble, but paying a high rent is no evidence of a large produce, or even of the tenant's prosperity. Mr. Pell then gives two instances of successful small farmers—one, who is still a labourer and who first "joisted" a cow and has now 27 head of cattle, and "who never deserted his master in harvest or time of need." The other is the under-manager of a stocking factory, and rents 12 acres. But as these two worthy men were both once Mr. Pell's ploughboys, and can now have "all the money they want, without interest," from their old master, they assuredly possess some substantial advantages which do not fall to the lot of every small farmer. Another more common case mentioned by Mr. Pell is that of a farm bailiff's widow, who with her son hires 25 or 30 acres. The widow "sells milk, carries it out herself morning and evening, and makes cream-cheeses in the summer." The last illustration he gives is that of a retired shopkeeper, who lives in his own house, owns some land, and hires 20 acres more. This tenant seems to be an excellent farmer, but is reported as "rather fond of barrowing the dung off my land to his; but that is natural, and shows knowledge of the value of dung." Mr. Pell concludes thus:—

"Now if you were to ask me, how these people make it pay, you would pose me; it is a thing no man *can* understand."

Arriving now at Herefordshire, Mr. Thomas Duckham says:

"You have set me a task. I am utterly at a loss to know where the pull is that a small holder has over a large farmer, beyond the fact, that, with a small holding sufficient to occupy his whole time, he may by dint of perseverance and hard work earn a little more than when working as a day labourer."

Mr. Duckham then mentions two small holdings which have been merged in his farm, the former occupiers having lost money and deteriorated the land, and he then gives an interesting and detailed account of men who have raised themselves by adding a little land to their other employments, and concludes:

"They clearly show that as in large, so in small farming, close attention, industry and frugal living have much to do with success. Of course there are exceptions; heavy losses will blight the most persevering occasionally."

The last opinion I will record is that of Mr. John Treadwell, whose experience as a practical farmer will carry weight far beyond the limits of Buckinghamshire. He says :—

"I have been looking all round to discover the small farms' advantages over large ones, but can see nothing as regards produce to their advantage. It is all the other way; poor and impoverished stock; poor and impoverished crops; poor, and in many cases ruined men. I have seen many men that have saved a little money in trade, invest it in stocking a small farm, and very soon lose it all; working hard and living hard, and all to no purpose. A few labourers have saved a little money, have got a horse and cart and then a bit of land, and have done some dealing in coal, hay, &c., and have got on, but they require to continue their trade or business to keep the farm going. Where a man has got a bit of land, and has kept a few cows, it has been a very hard fight with him to keep going, the price of butter being so low of late. There are lots of small holdings all along the Chiltern Hills, but in most instances the land is very badly done, and of course produces very bad crops, and scarcely keeps any stock, and that of the worst description. Most of the flint carters have small farms, and then have to work very hard to get a living. My opinion is, that as a rule in this country, the small farms employ the least labour, are the worst farmed, and produce much less produce. I used to live near a small farmer, well-to-do for his station. He was a bad farmer, he did a deal of work himself, yet was always behind with everything. I said to him, 'How is it that you do so much work yourself, and yet are always behind?' His answer was, 'You see when a job wants doing, we think that we will do it ourselves, and it goes on, until we can find time to do it, which time never comes, so it does not get done; that makes us always behind.' There is one great advantage in small holdings; they do not require so much capital to start with; and there is another, they enable a man in other business, a dealer, a butcher, or such tradesman, to carry on their trade more economically, and eventually to get into a larger farm, if their business succeeds."

As my correspondents have given some interesting instances of small farmers rising in life, I must be excused if I furnish one illustration of my own. When I came to this farm twenty-one years ago, my nearest neighbours were three farmers who occupied among them about 600 acres. The first I could remember as a day labourer upon my father's farm. He led an entire cart-horse during the season, and was born "lucky to pigs." He afterwards took a little land, and then more, but he has always stuck to his entire horses. The second was a working brickmaker, who saved money at piece-work, hired a small farm and added to it, but killed a pig weekly and retailed the pork in the parish until he removed to a larger farm. The other had been a farm bailiff, and when he took to farming on his own account, being a capital judge of stock, he did a good bit of dealing. No doubt these outside callings helped the farms, and the farms helped the trades, but if these men had

not been industrious, and if each had not possessed a special talent for his special business, they would not have succeeded in life as they have done.

Just one word upon Wales. That country is full of small farms, and until quite recently the wave of agricultural depression had reached only the outside portion of the Principality. But during the last two years the depreciation of cattle and dairy produce has smitten the Welsh farmer severely; some rebel against the payment of tithes, and others threaten to import the Irish Land League across St. George's Channel. What will happen in Wales, should agricultural distress long continue, when at its first visitation the Welsh farmer shows such signs of irritation and rebellion, is difficult to foretell. When distress has lasted a dozen years and become chronic, as in the grain-producing counties of England, both parson and landlord will have a dreary time of it in Wales. Judging from what has recently appeared in the Society's 'Journal,' numerous small farms in South Wales have been added to the larger ones, and, when so amalgamated, they have been better farmed, and have produced more corn and cattle. Latterly, the tendency to put down land to grass has greatly increased, and the cultivation of wheat is much diminished. Very little improvement in the tillage of small farms seems to have taken place of late, and what I wrote in the prize essay of the "Farming of South Wales"* nearly forty years ago of the small farmers of the Principality, is, I am told, almost as correct now as it was then. After stating the exceedingly small profits that accrued from the scourging agriculture of those days, I wrote:—

"But it will be naturally asked, how do the farmers live? They depend chiefly on the young stock to pay the rent, and rely on the dairy, which continually brings in ready money, to meet other current expenses. In addition to this, the small farmer and his sons do the principal work and repairs of the farm. They have thus hardly any outgoings for labour or tradesmen's wages, and live in a style of patriarchal simplicity almost entirely on the produce of their own land."

The poor encouragement which "The Small Farm and Labourers' Land Company" has received, shows that, however some philanthropists may believe in the advantages of peasant ownership, the general public has no great faith in the financial success of the small farmer. Here is a *bonâ fide* honest attempt to demonstrate as a matter of business, and not of philanthropy, that estates can be bought and sold or let piece-meal, and pay a reasonable dividend upon the money so employed. The Board

* 'Journal' R. A. S. E., 1849, vol. x., first series, p. 122 *et seq.*

is composed of honourable practical men of different stations and different politics, all deeply interested in land, who gratuitously devote a great deal of valuable time to the management of the Company, and who are only prevented from making the venture a commercial success from want of funds. If it had not been for the princely liberality of one of the directors giving a good-sized farm to the Company to be "butchered and cut up," this interesting experiment could not have been started for want of funds. It is surely well to try what private enterprise and individual exertion can do, before compelling local authorities to undertake duties which have been badly performed by such bodies. If small farms can be made to pay, there is no need—save in facilitating the transfer of land—for legislation; for speculators will always crop up, and there will be plenty of owners only too ready to sell land. If such holdings will not answer, then it is unwise to make the ratepayers play such a losing game. The Royal Commission on Agriculture reported against "artificially stimulating a system ill adapted to the habits of the people, or the condition of agriculture in England;" a conclusion which any one practically acquainted with English farming and rural life will readily endorse.

CONCLUSION.

I am painfully conscious that instead of making a *contrast* between large and small farms, I have written a confused *jumble.* Had the comparison been made fifteen years ago, when all things went well with farming, there could have been no difficulty in pointing to the superior products and profits of large holdings. During the past decade, the tide of prosperity has turned dead against extensive corn growing. Now the produce of grass-land suffers almost as severely, and the small occupier has, during the past two years, for the first time felt the pressure of really bad times. Whether he will be able to stand that pressure as well and as long as the larger tenants have fought against their losses, time alone will prove. The arable farmer has had painful experience of the truth of Sir John Lawes's matured opinion, "that high farming is no remedy for low prices." The small farmer is seldom a high farmer, and it is hardly possible for his frugality and economy to be much further extended. The stiff rent he has hitherto paid can no longer be expected of him; but at present there is no great difficulty in letting small farms, which can be carried on in conjunction with some other calling, and therefore all the necessary relief can be hardly expected from the landowner. The idea that the English farmer must conform still more closely to the model of the Continental

peasant, and live and work still harder than he does now, even if it were possible, is not desirable. There is much to admire in the thrift, the self-denial, and the industry of the Continental peasantry, and there may be something to learn from their better manipulation of their small products; but to recommend to a race of hardworking Englishmen a life of grinding poverty is not likely to prove attractive to the individual or beneficial to the community.

II.—*On Water Supplies suited to Farms and Villages.* By WILLIAM ANDERSON, M.Inst.C.E., Consulting Engineer to the Royal Agricultural Society.

IN an excellent paper, "On the Composition and Properties of Drinking-water and Water used for General Purposes," * the late Dr. A. Voelcker pointed out that the supply of water in rural districts was often not only deficient in quantity, but was frequently largely impregnated with sewage and with yard and house drainage.

He proceeded to classify the different kinds of water available, namely, rain-, river-, well-, and sea-water, and further subdivided these into soft and hard waters.

Under the head of Soft Waters, he described the properties of river and lake waters, springs, and wells; he pointed out the danger which arises from the action of some soft waters on the lead linings of cisterns, or on the inner surfaces of lead pipes, and gave simple directions for detecting this action and ascertaining whether water was actually contaminated with lead. He pointed out also that soft waters acted on iron pipes, and that galvanizing was not necessarily a protection.

Under the head of Hard Waters, Dr. Voelcker explained that springs which rise in the oolite or chalk-formations, and all waters which flow over calcareous rocks, or pass through soils abounding in lime, are always more or less largely impregnated with carbonates and sulphates of lime and magnesia; and when the quantity so dissolved exceeded 16 grains to the gallon, the water was said to be hard. Pure soft water was capable of dissolving only a feeble quantity of carbonate of lime, but most natural waters contain more or less carbonic acid gas in solution, and then they become competent to dissolve as much as 20 grains to the gallon.

When hard water was boiled, or even merely heated, it frequently

* 'Journal,' R. A. S. E., 1875, vol. xi. p. 127, *et seq.*

lost its bright and sparkling appearance, and became milky, in consequence of the carbonic acid gas having been driven off by the high temperature, and the insoluble chalk or carbonate of lime thrown down. To this action is due the heavy and destructive sediments which choke up boilers and hot-water pipes. The sulphate and nitrate of lime, which are also commonly found in hard waters, are dissolved independently of carbonic acid gas, and are, therefore, not thrown down, except under very high temperatures due to high-pressure steam.

Soft water readily produces lather with soap ; hard water, on the other hand, destroys much soap before a lather is formed. Soap may be regarded as a soluble compound of soda with fatty acids ; but with lime these fatty acids form insoluble compounds, and hence it is that hard waters are deprived of lime, or softened at the expense of soap. The carbonate of lime in water used in washing decomposes about ten times its weight of soap, and the salts of magnesia act in a similar manner.

Dr. Voelcker proceeded to enumerate the properties to be preferred in a water intended to be used for drinking and general household purposes ; these he stated to be :—

1. Freedom from putrescible organic matter.
2. Freedom from constant, or even occasional discoloration by clay and vegetable matter, with perfect brightness and clearness.
3. Freedom from smell and disagreeable taste.
4. Softness.
5. Coolness.

In the examination of water, particular attention should be paid to ascertain the quantity of organic matter which a given sample may contain, and also to trace, if possible, the origin of organic impurities, and to determine whether they proceed from decomposing animal-refuse matters, or from harmless vegetable substances. Wholesome and perfectly unobjectionable waters are always bright and free from colour ; but the converse is by no means true, for perfectly limpid and colourless waters may be dangerously contaminated.

If water has a yellowish colour, and at the same time a more or less nauseous taste or smell, no chemical analysis is required to prove its unfitness as a beverage ; for such water is certain to contain decomposing organic matter of animal origin. Light floating particles of suspended organic matter also frequently afford indications of the unwholesome character of water.

Dr. Voelcker goes on to describe how anyone may ascertain, by very simple experiments, the general character of a water, then gives instructions for sending samples up for analysis, and

concludes by describing the various means employed for purification. I would strongly recommend everyone who desires information respecting water supply to read Dr. Voelcker's paper, and note well the valuable instruction which it contains.

I will here mention a very simple and rapid method of detecting organic impurity in water. Take two tumblers, fill one with water which is known to be pure—for example, distilled water, which can always be got at a chemist's—and the other with the water to be tried. Add to each 3 or 4 drops of a weak solution of permanganate of potash (two grains of the solid salt dissolved in a tumbler of distilled water); then the pure water will assume a clear pale magenta colour, but in the other, if contaminated, the colour will rapidly turn to a salmon hue, become much paler, and, if too much permanganate has not been added, the colour will almost entirely disappear. The use of the glass of distilled water is to enable a comparison of colours to be made.

A friend of mine, a planter in Jamaica, was in the habit of daily testing, in the manner described, the water of the stream which flowed past his house, and from which he derived his supply. On one occasion the colour turned to brick red; he immediately searched the upper reaches of the stream, and at a distance of about a mile found the decomposing carcase of a cow lying in the water.

The permanganate test is not infallible, because the colour of the solution is affected by some mineral substances; but it is a useful guide in most cases.

Since Dr. Voelcker's paper was written, the labours of Pasteur, Tyndall, Dr. Burdon Sanderson, and others, have greatly extended our knowledge of the true cause of the spread of contagious diseases. It is now known that the so-called zymotic diseases are propagated by living organisms, which increase and multiply in impure waters—that is, waters charged with animal and vegetable matter; and such waters are dangerous, not from the dead matter contained in solution, but on account of the probability of dangerous living germs and organisms getting into them, developing and propagating with astonishing rapidity. Absolutely pure water would contain no food for living creatures; hence, the purer water is chemically, the safer it is likely to be. This great question of the propagation of contagious diseases among human beings and animals is still in the experimental stage, and much remains to be done before mankind will be in complete possession of the laws, which govern the spread of disease, and of the most efficient means of defence; so that, although there can be no question that absolutely pure water is the best and most wholesome, there is as

yet no proof, water being always more or less impure, that the presence of some plants and animalculæ is not an advantage, for they are probably the agents in that spontaneous purification which water under certain conditions undergoes. Just as small birds place a check in the development of many harmful insects, so certain forms of infusorial life may be charged with the office of destroying and exterminating harmful germs and microbes.

It is impossible to dwell too strongly upon the immense importance of well considering the surroundings of a proposed source of water supply, and this is particularly important in the case of dairies, where the deadly consequences of using bad water is felt in every family supplied. But too many cases may be cited where dairies, using water defiled by sewage proceeding from patients suffering from zymotic diseases, have been the means of spreading those diseases, and bringing suffering and death into the families which they supplied. The recent action of the Legislature, in placing dairies under strict supervision, is the direct fruit of our advanced knowledge, and it will be the means of forcing upon the ignorant or careless cow-keepers those great principles, which, though at first they may consider as tending to hamper the liberty of the subject, they will eventually find conducive to their trade interests, because the health and efficiency of their cattle will improve in consequence of the enforced care which will have to be bestowed on them.

It is a very common, though a very erroneous idea, that dumb animals are not particular in what they drink. Like men, they will drink anything when pressed by thirst; but pure water is as necessary to the lower animals as it is to man, and bad water will spread infectious diseases among cattle just as readily as among ourselves.

I will again touch on the quality of water, and the peculiar sources of contamination, as I deal with each method of supply. I will, however, remind the readers of the 'Journal' that an analysis of water can be obtained by Members of the Royal Agricultural Society at the excellent Laboratory attached to the Society's offices in Hanover Square.

Rain-water.

The most obvious source of water supply is the rain which falls on the roofs of our houses, and which can, as a rule, be readily collected by the eaves-gutters, and run into suitable cisterns. Rain-water is, however, far from being irreproachable, when required for drinking and cooking purposes, especially when the house is situated in a town or village. The water falling through the air readily absorbs carbonic acid gas, am-

monia and air, and on the roofs it acquires a yellow, and even inky colour by dissolving a good deal of organic matter, and slowly washing away the excrement of birds and cats, as well as the nests and dead bodies of birds and insects, which are frequently found in the gutters. These impurities form a fitting food for infusoria; hence any germs of disease, floating in the air or resting on the roofs, find a congenial home where they can breed and multiply. In addition, a good deal of soot is washed down, which, at times, gives the water a very offensive colour and smell. For all these reasons, filtration through sand, at all events, is indispensable; but a perfectly safe, colourless, and almost tasteless water can be produced by purification with iron. I say *almost* tasteless, because it is very difficult, if not impossible, wholly to remove the sooty taste and smell, so that it will not be perceived in drinking-water.

When it is desired to use the rainfall as a source of supply, it is indispensable to have tanks or reservoirs large enough to store every drop of water that falls. From a study of the records of the monthly rainfall in various places in England, I find that the storage capacity has to be from 15 per cent. to 20 per cent. of the total rainfall. If monthly records, extending over some years, have been kept in the neighbourhood of a proposed water supply, they should be examined, and the most irregular year picked out. The mean monthly rainfall, usually given in terms of the depth of water fallen in inches, will be found by dividing the total fall by 12; then all the rain which fell consecutively above the mean during a number of months will represent the number of inches of storage required.

Thus in Manchester, during the year 1858, 36·48 inches of rain fell, which is at the rate of 3·04 inches per month; this being also the average rate at which the water may be consumed. During the month of August there fell 1·43 inches over the mean, during September, 0·69 inches, and during October, 2·16 inches; making a total of 4·28 inches above the mean consumption. There was no other period during that year when the excess was so large; hence the storage required would be 4·28 inches deep out of a total fall of 36·48 inches, which is nearly 12 per cent. It would generally be safe to store one-sixth of the total rainfall.

The quantity of rain which falls every year varies enormously, according to the position of the locality. The western side of the country has three times as much rain as the east coast, and the mountainous districts are more abundantly watered than the plains. I will take 24 inches per annum, or 2 inches a month, as a safe average.

The quantity of water required per head depends on the

nature of the house. Cottagers, even when they have water under pressure laid on, do not consume more than 5 gallons per head per day; and when they have the trouble of pumping or raising from a draw-well, the consumption probably does not exceed 3 gallons per head per day.

A rainfall of 24 inches on the roofs will yield about 12 gallons per square foot, measured on the flat, per annum. A pair of two-storied labourers' cottages, having a roof area of about 1150 square feet, would therefore yield on an average $\frac{1150 \text{ sq. ft.} \times 12 \text{ galls.}}{365 \text{ days}} =$ 38 gallons of water per day; and if there be 10 inmates in the two houses, this would give nearly 4 gallons per head per day. The total annual rainfall would be 1150 square feet $\times$ 12 gallons = 13,800 gallons, and the storage capacity should be one-sixth of that amount, or 2300 gallons, which would be contained in a tank 8 feet square, and $7\frac{1}{2}$ feet deep. A contingent advantage of a large storage tank is, that it gives time for the water to get tolerably clear by subsidence, and, on this account, such tanks should be easily accessible for cleaning, as considerable quantities of solid matter will collect in the bottom.

The storage-tank should be placed so as to be accessible from both houses. An obvious arrangement would be to raise the bottom about 18 inches above the ground, and insert a cock by which the water could be drawn off, the eaves-gutters being trained to discharge direct into the tank. I am afraid, however, that such convenience would lead to waste, and I would recommend the tank or cistern to be placed underground, made of brickwork, in the form of a perfectly water-tight well, 6 feet diameter, and 15 feet deep, domed over and fitted with an ordinary lift-pump, by means of which the water could be raised as required at the expense of a little time and labour, which will effectually prevent waste.

In such an arrangement, the tank should be placed at a little distance from the cottages, and quite beyond the reach of any offensive drainage soaking through the ground; the pump might be quite near the house, and so arranged that the water slopping about it should not be able to get into the cistern again.

A much more complete installation, however, would be to place the storage-tank as high as the eaves-gutters will allow, then arrange a sand filter about 15 inches square supplied from the tank by a $\frac{1}{2}$-in. ball-cock, and allow the filter to deliver, also by means of a ball-cock, into a service-tank holding about 20 gallons. This would allow the filter to run continuously night and day, and insure a supply of fairly clean and colourless water. This arrangement of filter is illustrated for a larger installation in Fig. 1. The outlay necessary to make the arrangements indi-

cated would be considerable. Thus, an iron storage-tank with cover and cock, would cost 40*l.* if placed aboveground. A cistern underground of the same capacity, with its pump, would cost 21*l.*, and the filter and service-tank would come to about 3*l.* I am sure, however, that many landowners, who wish to see their labourers well provided, would not hesitate to incur the expense necessary to give the priceless boon of a fair supply of good water, and would moreover see that the appliances provided at so much cost were kept in proper order. The filters, for example, will require cleaning from time to time—that is, the top layer of sand, about 1 inch thick, will have to be removed, washed, and replaced; a little fresh sand will have to be added now and then to make up for waste. This operation can be performed in half-an-hour, but it is, nevertheless, very likely to be neglected.

For the supply of homesteads similar arrangements can be made. The whole of the eaves-gutters should be connected by down pipes to a common main-pipe, which would lead to the storage tank. It is best to connect the eaves-gutters at about their own level as much as possible, so as to avoid underground pipes, which are apt to get choked; and the gutters should be of ample size, in order that no storm-water may be wasted by overflow. The underground pipes should be laid as much as possible in straight lines, converging to small catch-pits, which could readily be opened and the pipes cleaned by the insertion of long rods, should any stoppage occur.

In vol. xv. (1879) of the 'Journal' will be found the plans and descriptions of a homestead for a dairy-farm of 400 acres. The available roof-area of all the buildings is 35,487 square feet, hence a 24-inch (2 feet) rainfall would yield

$$\frac{35{,}487 \text{ sq. feet} \times 2 \text{ feet} \times 6\cdot2 \text{ galls.}}{365 \text{ days}} = 1206 \text{ galls.}$$

per day, and the storage capacity should be at least $\frac{35{,}487 \text{ sq. feet} \times 2 \text{ feet}}{6} = 11{,}829$ cubic feet.

According to Dr. Parkes, a horse requires a minimum supply of 6 gallons per day; cattle, 5 gallons; swine, 1 gallon; and men, say 6 gallons.

The requirements of the homestead may be thus calculated:

11 Horses	at 6	gallons	per head	=	66	gallons	per day.
170 Cattle	„ 5	„	„	=	850	„	„
150 Swine	„ 1	„	„	=	150	„	„
Say 8 Men	„ 6	„	„	=	48	„	„
		Total ..	..		1114	„	„

The roofs, we have seen, will yield a little more than the above minimum requirements.

In this case a storage-tank of iron, or even of masonry, would prove very expensive, consequently a pond or open earthwork reservoir (Fig. 1) would have to be provided. If the ground happen to slope up, so as to allow of a pond being dug in the ground at a somewhat higher level than the floors of the buildings, the cheapest and most convenient arrangement possible will result. If the ground be impervious to water, it will be only necessary to dig a hole 55 feet square at the surface, by 6 feet deep, with the sides sloping $1\frac{1}{2}$ horizontally to 1 vertically. If the ground be porous, the pond will have to be lined with puddle—that is good stiff clay worked into a plastic mass and laid from 6 inches to 9 inches thick all over the bottom and sides—and the latter, at any rate, should be protected by paving of some kind over the puddle; brick on flat will do, but concrete in cement about 4 inches thick will answer equally well. Concrete alone, however thick, will not make a water-tight basin, even when it is quite free from cracks (which is rarely the case) and rich in cement, whereas puddle never cracks, and remains absolutely tight as long as it is undisturbed. If the puddle be protected in either of the ways mentioned, its thickness may be reduced to 6 inches. Should there be no high ground available, the pond can be made on the surface by an embankment about 6 feet high, enclosing the required area, as shown in Fig. 1. The crest should be about 3 feet wide, and the banks sloped inside and out $1\frac{1}{2}$ to 1. The inside must be lined with puddle and concrete, or brick, in the manner described above. The cost of a plain pond will be about 16*l.*; of one lined with puddle and concrete, 46*l.*; and one made on the surface, 65*l.* A low, but close fence should be placed round the reservoir to prevent animals getting access to it.

The diameter of the main-pipe bringing the water to the reservoir must be calculated on the assumption that 1 inch of rain may fall in an hour; this over the area of roofs will give a rush of 50 cubic feet per minute; and, assuming a maximum velocity in the pipe of 6 feet a second, or 360 feet per minute, the area of the pipe will be $= \dfrac{50 \text{ c. ft.}}{360 \text{ feet}} = \cdot 137$ square feet, which corresponds to a 5-inch pipe. If the reservoir be on a higher level than the ground this pipe will be under pressure, and should be of cast-iron with properly made lead or rust joints. The down pipes from the eaves-gutters should be carried as much as possible on a level higher than the reservoir, so as to avoid having more of the expensive underground pipe than is absolutely necessary.

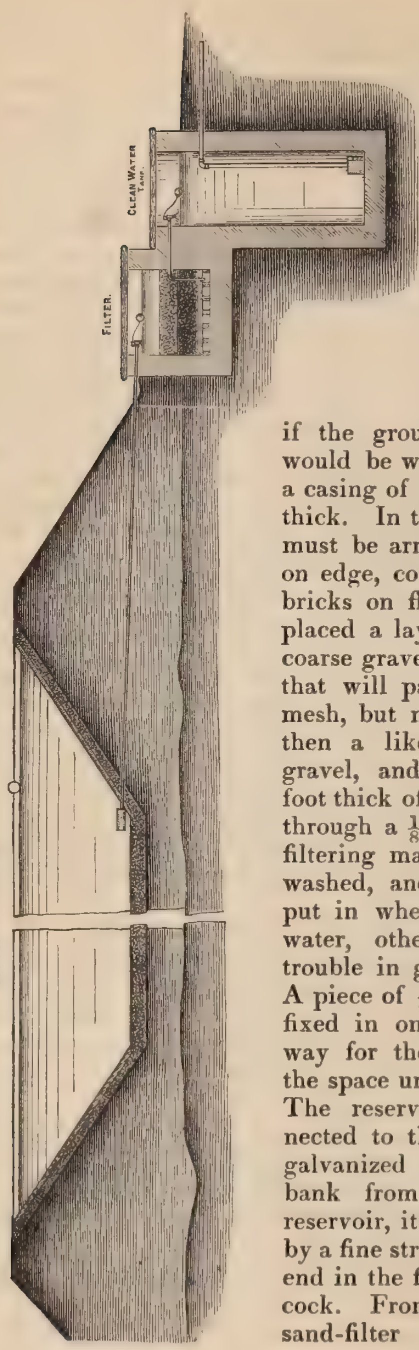


Fig. 1.—*Section of Storage-Reservoir, Filter, and Clear-Water Tank.*

At some convenient spot a sand filter 4 feet 6 inches square (Fig. 1) should be built. Its depth should be 4 feet 6 inches, and it may be made of brickwork, masonry, or concrete, with walls and bottom about 14 inches thick, rendered in cement inside, and, if the ground be very open, it would be well to surround it by a casing of puddle about 6 inches thick. In the bottom of the filter must be arranged rows of bricks on edge, covered by a roofing of bricks on flat; on this must be placed a layer 6 inches thick of coarse gravel, composed of stones that will pass through a $\frac{1}{2}$-inch mesh, but not through a $\frac{1}{4}$-inch; then a like thickness of finer gravel, and finally a layer one foot thick of fine sharp sand sifted through a $\frac{1}{8}$-inch mesh. All the filtering materials should be well washed, and the sand should be put in when the filter is full of water, otherwise there will be trouble in getting rid of the air. A piece of $\frac{3}{4}$-inch pipe should be fixed in one corner to make a way for the escape of air from the space under the bricks on flat. The reservoir should be connected to the filter by a $\frac{3}{4}$-inch galvanized pipe laid through the bank from the bottom of the reservoir, its end being protected by a fine strainer, and the delivery end in the filter fitted with a ball-cock. From the bottom of the sand-filter a $\frac{3}{4}$-inch galvanized

pipe should rise to about the middle of the sand layer, and should then pass out horizontally through the brickwork and terminate in a ball-cock in the clear-water tank. The object of taking the pipe out about the middle of the depth of the sand is to prevent the water being drawn below that level, and so removing all risk of air getting into the lower part of the filter, and giving trouble when it fills again. The storage tank should have a capacity of about 120 cubic feet, so that the filter might run steadily night and day. The storage-tank would be best underground, for the reasons already given, and might be made in the form of a water-tight well 4 feet diameter and 10 feet deep. From this a pump worked by hand or by power would draw the water as required. The filter and the storage-tanks should be provided with covers to keep the water in the dark, to guard against accidental contamination, and to protect from frost. The underground tanks have an advantage over iron tanks in that they keep the water cooler in summer and from freezing in winter. Darkness is very advantageous, because it prevents the growth of weeds and many varieties of animalculæ.

Mr. G. M. Allender's estimate of the supply of water required by a dairy-farm is much higher than the quantity which Dr. Parkes prescribes as a minimum; he estimates that 10 gallons per head per day should be provided for horses and cattle, and 5 gallons for pigs. The roof area of the Aylesbury Dairy Company's farm at Horsham is 80,000 square feet, or nearly 2 acres. It covers, besides various offices, 168 cows, beasts and horses, and 150 pigs, which require therefore a supply of at least 2430 gallons per day, while the roofs will yield 2728 gallons under a 24-inch per annum rainfall,—rather in excess therefore of what is required. Again, a gentleman's house in the country, with gardens, greenhouses, and stables, requires from 25 to 30 gallons per head per day, on the average number of inhabitants, and 10 gallons for horses and cattle, and 5 gallons for pigs; the roof area would in such a case be quite inadequate.

In the case of my own house, containing 16 individuals, but neither horses nor cattle, the area of all the roofs, including that of a gardener's cottage, amounts to 8500 square feet. The house is supplied by metre from a water company; the average annual consumption is 17,700 gallons, which includes a good deal of water used in the summer time in the flower and kitchen gardens, which are furnished with 10 hydrants, but it does not include a considerable quantity, probably 4000 gallons per annum of rain water, which is collected in tanks and used for washing purposes, on account of the extreme hardness of the pipe water. The roofs, at 24-inch rainfall, would yield 105,000

gallons per annum, hence the large deficiency of, at least, 76,000 gallons would have to be made up. The only way to do this, in localities where the rainfall alone must be looked to, is to form artificial gathering grounds by railing in a sufficient area of land (if sloping, so much the better), and after forming the surface so as to drain to a particular point, to cover it with a layer 3 inches thick of cement, concrete, or bricks on flat laid in cement, or stone shingles set in the same way.

To collect 76,000 gallons at 12·4 gallons per square foot per annum, would need a gathering ground of $\frac{76{,}000}{12 \cdot 4} = 6130$ square feet, or 681 square yards, or a little over 26 yards square. The cost of this, including a fence round the ground, would be about 80*l.* A storage reservoir of $\frac{181{,}000}{6} = 30{,}166$ gallons would have to be provided to take the water of the roofs and gathering ground at a cost of about 150*l.*, so that for an outlay of about 230*l.* my house could be made independent of the water company.

My water rate comes to 11*l.* 11*s.* per annum, which is about 5 per cent. on the above outlay, so that the rain water would cost no more than the pipe water; I should, however, have to pump a portion of it to the top of the house, which would involve some expense.

The water collected in this way would be cleaner than that taken from the roofs only, and filtration, except for table purposes, might be dispensed with, as the settlement in the large storage reservoir would make the water fairly clear.

It is sometimes possible to make such artificial gathering grounds at some distance from the house on ground sufficiently high to command it completely; in such cases an admirable water supply may be assured, and by making the area of the ground sufficiently large, and the storage-tank of adequate capacity, an abundant provision may be made against fire, and even for providing power for working lifts and hydraulic motors for domestic or for dairy purposes, especially as the waste water, after having been used in these appliances, can be employed for many purposes in the houses and gardens.

The larger the annual rainfall, the cheaper it is to carry out the arrangements necessary to collect and store it.

Artificial gathering grounds may be laid out at about 1*s.* 10*d.* per square yard, with about 3*s.* per lineal yard for fencing all round, and underground reservoirs cost about 6*l.* 10*s.* per 1000 gallons, when the capacity is below 20,000 gallons, and from 4*l.* 10*s.* to 5*l.* per 1000 gallons for larger reservoirs.

Before proceeding to consider the next sources of supply,

that is, springs, lakes, and rivers, I must say a few words about pipes.

Water flowing through pipes meets with considerable resistance, in consequence of its adhesion to the sides of the pipes and the effort necessary to make the particles of water slide over each other, or over the surface of the metal; this is commonly called "skin friction," and it varies directly as the length of the pipe and directly also as the square of the velocity with which the water flows in the pipe, and consequently as the square of the quantity which the pipe delivers per minute. To overcome this resistance, a certain amount of pressure is necessary, and if water be flowing naturally through a pipe, the pressure assumes the form of a column of water, the height of which must increase with the length of the pipe, or must increase as the square of the quantity of water to be discharged increases, and this column is measured as the difference of level between the water at the upper end and that of the water at the lower extremity of the pipe.

If the water has to be pumped through the pipe, then the pump must exert a pressure above the actual height to which the water is raised, corresponding to the pressure of the column of water which would be necessary to make the water flow naturally. Thus a one-inch pipe, 1000 feet long, will discharge a little less than 2 gallons per minute, if laid at a slope of one foot fall in 200 feet length, or so that its upper end will be 5 feet higher than the lower; but to discharge double the quantity, or nearly 4 gallons per minute, the slope will have to be one in 50, and the difference of level between the two ends will be 20 feet, or four times as much as before.

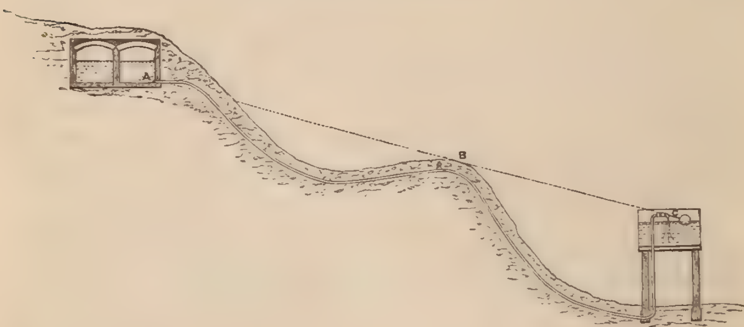
If the length of the pipe be halved, its slope or "hydraulic inclination," or "gradient," as it is called, will still have to be the same for the same discharge, but as the length is halved, the difference of level between the two ends will also be halved.

A pipe will be under the most favourable conditions if it be laid at a uniform slope, but such an arrangement is seldom possible. If it run from a reservoir, say, into a service-tank in a house over undulating ground, it will start from the bottom of the reservoir, and deliver by a ball-cock into the service-tank; in that case the difference of level, under which the pipe is discharged, will be the vertical height from the ball-cock to the water level in the tank, and the hydraulic inclination will be this height divided, not by the direct distance between the two points, but by the length of the pipe. Thus: suppose the pipe to be 1,260 feet long and the difference of level 6 feet, then the hydraulic inclination will be $\frac{1260}{6} = 1$ in 210. In cal-

culating the size of the pipe required for a given discharge, the least difference of level must be taken, or, in the case above quoted, the height from the water-level in the tank, when nearly empty, down to the ball-cock.

The pipe may follow the undulations of the country, provided no point rises above the line of uniform slope.

Fig. 2.—*Section of Reservoir and Ball-cock in lower tank, showing the Hydraulic inclination.*



Thus, if A (Fig. 2) be the reservoir, and C the ball-cock in the lower tank, then A C will be the direct hydraulic inclination, and no undulation such as B may rise above the line A C, and, moreover, it is necessary to fix a small air-cock at the highest point of each vertical bend such as B, for the purpose of letting out the air, which is very apt to collect in the bend and obstruct the flow of the water.

The pipe may follow any course out of the direct one that may be convenient, but the more the pipe deviates from a straight line, the longer it will be, therefore the smaller will be the hydraulic gradient, and the smaller the discharge.

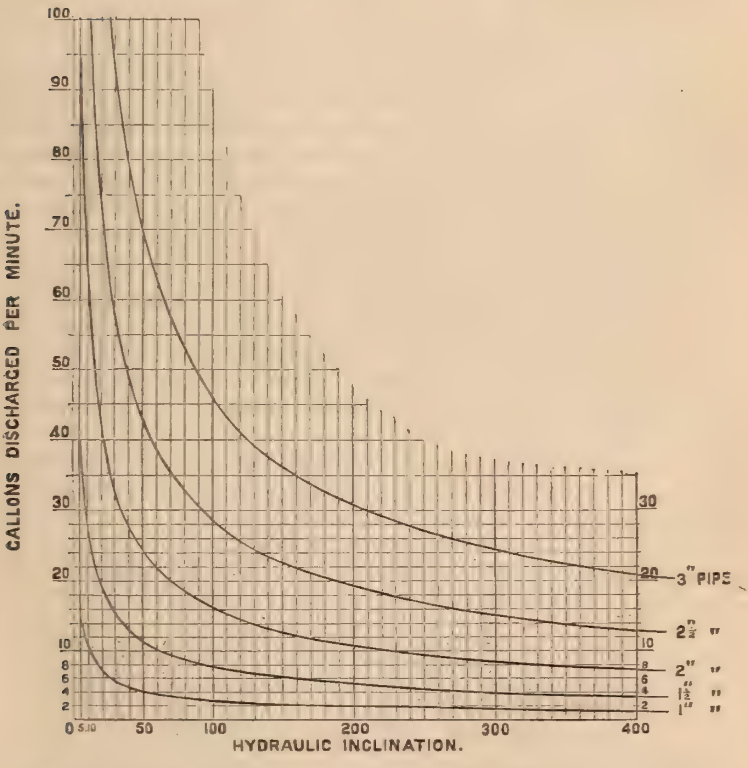
The pipes generally used for small water mains are 1-inch, 1½-inch, and 2-inch bore, usually of galvanised iron, with screwed couplings, and 2½-inch and 3-inch bore of cast iron, usually coated with a composition to prevent them rusting. The joints of the latter are made with lead or iron borings. The 2½-inch pipes are generally made in 6-foot lengths, the 3-inch in 9-foot lengths; so that, by reason of the smaller number of joints, it is very nearly as cheap to lay 3-inch as 2½-inch pipe.

The following is about the price per yard laid, including trenching the ground and jointing materials:—

1-inch bore	..	..	2s. 6d.	per yard.
1½ " "	..	..	3s. 3d.	"
2 " "	..	..	4s. 9d.	"
2½ " "	..	..	3s. 10d.	"
3 " "	..	..	4s. 4d.	"

As the calculations for ascertaining the quantity delivered by pipes are rather troublesome, I have constructed a diagram (Fig. 3), from which the discharge of a pipe under any hydraulic inclination may be ascertained at once.

Fig. 3.—*Diagram indicating discharge of a Pipe under any Hydraulic inclination.*



The base-line of the diagram represents inclinations from 1 in 5 to 1 in 400, the vertical scale represents the number of gallons discharged per minute, and the five sizes of pipes that I have enumerated, are each represented by a curved line. The diagram is used in the following manner. Suppose a 2-inch pipe,

3450 feet long, has a fall of 20 feet, how much will it discharge per minute? The hydraulic inclination will be $\frac{3450}{20} = 172$ nearly. Look along the base for 170, the nearest number, and run the eye up the line till it reaches the curve of the 2-inch pipe; then follow the horizontal line to the scale on the left side, and you will find that nearly 12 gallons will be discharged. Or, again, suppose you want to know what sized pipe to lay under the above conditions to give 5 gallons per minute, find the spot where the 170 vertical line intersects the 5 gallon horizontal line, and you will find that the nearest largest pipe will be $1\frac{1}{2}$ inch diameter. By such means as this, every problem connected with pipes can be solved. Main-pipes should always have a cock near their origin, so that they can be emptied without emptying the reservoir, and at the lower end there should be a lateral cock or "wash-out," near some convenient drain or pond, so that the pipe may be emptied without making a mess. The lower tank should have a visible overflow, in order that, if the ball-cock fail to act, the overflow will at once give warning and prevent waste of water; and as ball-cocks are very apt to get out of order, it is well to have a cock in the main-pipe close behind it, so that the water may be readily shut off, or, if the tank be in a turret or in a house, the cock may be in any readily accessible place on the ground level.

It is not necessary to make the cocks of the same diameter as the main-pipes, because the resistance offered to water running fast through a cock, the length of which is insignificant, is very small indeed. The diameter of the mains has to be considerable, in order that the water may flow slowly, and the consequent frictional resistance be small, but no such restrictions are required in cocks. The following sizes of cocks will be found suitable:—

To discharge	about		4	gallons	per	minute, a	$\frac{1}{2}$	-inch	cock.
„	„	„	9	„	„	„	$\frac{3}{4}$	„	„
„	„	„	16	„	„	„	1	„	„
„	„	„	36	„	„	„	$1\frac{1}{2}$	„	„
„	„	„	64	„	„	„	2	„	„

Springs, Rivers, and Lakes.

Of the three sources of supply, springs, rivers, and lakes, springs are perhaps the best and safest, because their ultimate source is the rainfall over a large tract of open country; hence the waters are not likely to be polluted, and even such impurities as may be taken up in passing through the thin upper layer of cultivated and manured soil, are neutralized or de-

stroyed by the slow percolation through vast masses of strata, which exert a beneficial influence, partly by mechanical and partly by chemical action. One considerable disadvantage, however, is that the water is often hard. The next best source is, generally, the water of rivers, which, although liable to contamination from many sources, such as the drainage of cultivated fields, of houses, villages, and towns, have yet a marvellous power of self-purification. A stream considerably polluted will lose all trace of contamination in a run of two or three miles. Scientific men are not agreed as to the methods by which this purification is accomplished. It is probably due to several causes, namely, to the large surface constantly exposed to the action of the oxygen of the air, as the particles of water roll over each other; to the effect produced by aquatic plants and animals in assimilating the obnoxious, but to them, nutritive substances; and lastly, to the action of microbes, causing decomposition and precipitation of substances held in solution. Of course these natural purifying agents may be, and often are overpowered by extreme pollution, and there is always danger of zymotic contagion from the drain of a single house discharging near the point where a supply is taken.

Lakes or ponds without outlets are objectionable, because all the polluted matter carried in by the surrounding water-shed remains and becomes concentrated; but where outlets exist, they form very excellent sources of supply, especially if drawn upon at some distance from the shore, out of the reach of the immediate surface drainage.

Springs and rivers are sometimes so situated, that they are at a higher altitude than the places to be supplied, and in such cases, if the source has a minimum flow sufficient for the needs of the premises, nothing need be done but to construct a small basin to collect the spring, or to place a lateral sluice and strainer below the lowest summer level for the purpose of tapping the river or the lake. But very commonly springs and rivers fail towards the autumn; it then becomes necessary to construct reservoirs of sufficient capacity to store up two or three months' supply, and this may become an expensive matter. In the case of rivers, they are very commonly converted into reservoirs by placing weirs across them and collecting the water in the reaches above. Such a proceeding is not always practicable, on account of riparian rights and of the large area of good land which may be submerged. Again, most rivers, in flood time, have their waters greatly discoloured and rendered very muddy; in such cases, storage reservoirs are desirable, for they can be filled when the water is in good condition, and drawn upon in time of flood. But very commonly springs,

rivers, and lakes are below the premises to be supplied, and then it becomes necessary to raise the water by mechanical means. These may be divided into animal-power, water-power, wind-power, and heat-power.

Under animal-power, we must consider pumps worked by human beings, and those worked by horses or cattle.

Pumps are usually divided into two classes; lift-pumps, which deliver their water at the level on which the operator stands; and force pumps, which send it much higher. The lift-pump is generally the simplest and cheapest, being mostly open topped, and consists of a barrel into which is fitted a bucket, armed with a valve opening upwards, and a suction pipe attached to the barrel and fitted with a "foot valve," also opening upwards. The force-pump has a closed top; the bucket rod works through a packed gland, and a rising pipe branches from the upper end of the barrel, and is usually fitted with a valve opening upwards, though such valve is not essential to the pump.

For small powers, the pump is generally worked by a lever or "pump-handle"; in the case of more serious work, two or three pumps are placed side by side and worked by cranks so arranged that the barrels lift consecutively, and are actuated by winch handles and regulated by a fly-wheel.

The effort necessary to perform any work is measured by foot-pounds, that is to say, the unit by which work is measured is the effort necessary to lift one pound one foot high, and the rate of work is measured by the number of foot-pounds done per minute. Thus, a horse-power is 33,000 foot-pounds of work performed in one minute; a man-power working 10 hours per day at such steady work as pumping is 2000 foot-pounds per minute or less than $\frac{1}{16}$ of a horse-power.

In estimating the power required to do a certain amount of pumping, two allowances have to be made.

First, for the friction, or internal resistances inherent to the machine worked. This depends very much on the structure of the apparatus and the perfection of its workmanship, but in small hand-pumps, about 70 per cent. of useful work may be calculated on, so that a man-power may be taken at 1400 foot-pounds per minute, measured in water lifted. The second allowance is for the friction of the rising pipe. Suppose the dead lift to be 50 feet, a man pumping would lift $\frac{1400 \text{ foot-pounds}}{50 \text{ feet} \times 10 \text{ pounds}}$ $= 2 \cdot 8$ gallons per minute. Suppose the pipe were 2000 feet long and 1-inch bore, our diagram (Fig. 3) would give a gradient of about 1 in 90, or a resistance of $\frac{2000}{90} = 22 \cdot 2$ feet, so that the

total resistance to pumping will be 50 feet + 22 feet = 72 feet, but under such a pressure a man would not be able to pump 2·8 gallons per minute. As direct calculation is impossible, we must make a guess, and as the quantity pumped will be less than 2·8 gallons, the friction of the pipe will be also less, let us take it at 12 feet. Then the vertical lift will be 50 + 12 = 62 feet and the water pumped per minute will be $\frac{1400}{62 \times 10}$ = 2·2 gallons, which, by the diagram, corresponds to a gradient of 1 in 150, or an extra pressure of 13 feet, which is within a foot of what we guessed and near enough for practical purposes.

A man can do 1,200,000 foot-pounds in ten hours of pumping; this, at 70 per cent. duty, will be 840,000 foot-pounds of water lifted; hence suppose the water has to be raised a dead height of 50 feet, with about 13 feet 6 inches allowance for friction, he could raise 13,200 lbs. of water, or 1320 gallons, for his day's work, therefore a moderate-sized house, consuming 500 gallons per day, would keep a man pumping nearly four hours per day, and at 3*s.* per day, the water would cost nearly 2*s.* 6*d.* per 1000 gallons, a rather costly luxury. If the water had to be pumped more than 50 feet high, the number of hours' work would be increased in proportion, and the size of the pump, or its speed, would have to be so regulated as not to overpower the man. At steady work, such as pumping, a man cannot use a greater effort than about 14 lbs. on a winch-handle at a speed of 150 feet a minute, which would correspond to about 20 turns per minute of a 15-inch handle; and short intervals of rest would have to be allowed.

In selecting a hand-pump, care must be taken to fix the size in proportion to the lift, so as to get the best advantage out of the man's labour. Hand-pumps have generally a 6-inch stroke, and supposing a man works at 30 strokes a minute, the following table will be a guide:—

To lift not more than	68 ft. the barrel should be	2″	dia., 122	galls. per hour.
„ „ „	43 „ „ „	2½″	„ 195	„ „
„ „ „	30 „ „ „	3″	„ 273	„ „
„ „ „	17 „ „ „	4″	„ 491	„ „

Open-topped hand-pumps vary in price from 1*l.* 6*s.* for a 2½-inch barrel to 4*l.* 4*s.* for a 5-inch, and force-pumps from 2*l.* 15*s.* to 4*l.* 12*s.* for the same sizes. If brass barrels are required the prices are somewhat higher. Double-acting pumps, or double-barrelled pumps actuated by cranks arranged in self-contained cast-iron frames, cost from 15*l.* to 30*l.*, according to the size.

Horse-power is best applied by means of horse-gears in which the animal walks in a circle, being harnessed to a pole about 11 feet long, attached to wheelwork, which multiplies the speed of rotation, and transmits it by a horizontal shaft to the apparatus to be worked. In the sixth volume of the present series of the 'Journal,' page 461, will be found the report of the trials of horse-gears at Oxford in 1870. From the experiments made, it would appear that the efficiency ranged in the best machines from 73 per cent. to 79 per cent., and the prices from 11*l.* to 17*l.* 17*s.*

An average horse working 8 hours per day in a horse-gear exercises a pull of 100 lbs., at the rate of 3 feet per second, or a little more than 2 miles per hour; hence the total work per day will be 8,640,000 foot-pounds, of which, say 75 per cent., is available for working the pumps; but as these will do about 80 per cent. of useful work, being larger than the hand-pumps, the duty of the combined machine will be only 60 per cent.; so that a horse can lift $8{,}640{,}000 \times \cdot 60 = 5{,}184{,}000$ foot-pounds per day; and if the dead-lift be 100 feet, and the resistance of pipes 10 feet through 2400 feet of 2-inch pipe, then the delivery will be $= \dfrac{5{,}184{,}000}{110 \text{ ft.} \times 8 \text{ hours} \times 60 \text{ m.} \times 10 \text{ lbs.}} = 9 \cdot 8$ gallons per minute and per horse. The water lifted will be 4700 gallons per day; and if the horse and driver be charged at 8*s.* per day, the cost of the water will be about 1*s.* 9*d.* per thousand gallons raised 100 feet; or if the lift be only 50 feet, as in the case of the man pumping, the cost would be a little less than 1*s.* per thousand gallons.

Ponies and donkeys are often used for pumping. In such case, the size of the pumps or their speed must be adjusted to the strength of the animals used.

The disadvantage of the horse-gear is the large space it takes up. At the Colonial and Indian Exhibition last year, the Canadian agricultural implement makers exhibited several "horse-mills," as they were called, which consisted of a kind of stall just large enough to hold one horse or a pair of horses. The floor of the stall was inclined, and formed of wood planks hinged together, so as to constitute an endless chain, which passed over a spiked drum at the upper end. The incline of the floor could be varied according to the nature of the work. A brake was provided, by means of which the motion of the platform could be checked or entirely stopped. When a horse was put in, the end of the stall closed, and the brake taken off, the platform would slip away from under the horse, which would be obliged to walk to keep himself from falling; and so his

weight, acting on the incline, would communicate motion to the driving-drum and to any machinery connected to it.

I was informed that these horse-mills are very much used in homesteads, and that they answer very well, and do not injure the horses. They are compact, and may readily be fixed in a barn or stable.*

Rivers very commonly afford the power requisite for raising a portion of their own waters to any required height. Where the flow in the river is at all times ample, the required supply must be first determined, and then the quantity of water necessary to work the motor must be considered.

Small water-wheels, which can be used with very low falls, and even as stream-wheels in rapid rivers, may be estimated to do, with their pumps, about 40 per cent. duty, that is to say, the weight of water pumped per minute multiplied by the total height raised, including the resistance of friction in the pipe, will be 40 per cent. of the weight of water falling multiplied by the height of the fall. Thus, suppose that a house, using 500 gallons per day, has to be supplied by a water-wheel intended to work about 10 hours a day with a fall of 1 foot 6 inches. The water lifted would be a little under 1 gallon per minute. The rising pipe might be 1-inch diameter; our diagram tells us that the hydraulic inclination would be 1 in 200, and if the pipe were a mile long, the head of friction would be 26 feet. The absolute height to which the water would have to be raised is, say, 150 feet, making in all 176 feet.

10 lbs. of water $\times$ 176 feet $=$ ·40 $\times$ lbs. water expended $\times\ 1\frac{1}{2}$ feet; therefore the water expended would be $\dfrac{10 \times 176}{\cdot 4 \times 1\frac{1}{2}}$ $= 2933$ lbs., or 293 gallons per minute.

If a spot in the stream can be found with a few yards of tolerably even current and uniform cross section, the volume flowing down can be ascertained by observing the distance which floats cast into the middle of the stream travel in—say, one minute. The average velocity is found to be about 80 per cent. of the velocity in the centre of the stream, and the quantity flowing down will be found by multiplying the average depth of the water by the width at the surface, by the observed velocity, and by ·80.

Thus, suppose a stream is 4 feet wide at the water surface, and the depth of water measured in four places across the stream is found to be 4 inches, 6 inches, 10 inches, and 8 inches, the average depth will be 7 inches, and the cross section 4 feet $\times\ \frac{7}{12}$ feet

* In vol. xiv. of the 'Journal,' page 47, will be found an illustration of the manner of working three throw pumps by means of horse-gear.

= $2\frac{1}{3}$ square feet. The float went a distance of 120 feet in one minute; therefore, the average speed was $120 \times \cdot 8 = 96$ feet per minute, and the volume of water passing down the brook is 96 feet $\times$ $2\frac{1}{3}$ square feet = 224 cubic feet per minute, or 1389 gallons; hence the supply of water would be ample for the proposed installation.

But very commonly the stream is so irregular in its cross section and rate of fall, that a satisfactory test cannot be made in the manner just explained; it is best then to place a board across the stream so as to dam it completely, and to cut a rectangular notch in the top edge of the board sufficiently wide and deep to allow all the water to flow through as a cascade.* The notch should be about ten times as broad as it is deep, and the edges should be chamfered, on the down-stream side of the board, so that the thickness of the edges of the notch should not be more than $\frac{1}{4}$-inch. Two or three feet up stream, from the notch, drive a peg into the bed of the stream near its margin, and set the peg by means of a level exactly level with the bottom of the notch; then, when the water is flowing through, measure the depth of water over the top of the peg, and the discharge will be found by the help of the following table, which gives the quantity of water passing over a notch 1 inch long for various depths:—

Depth of water.	Gallons per minute, per inch in length.
$\frac{1}{2}$ inch	·944
$\frac{3}{4}$ "	1·734
1 "	2·670
$1\frac{1}{4}$ "	3·818
$1\frac{1}{2}$ "	4·905
$1\frac{3}{4}$ "	6·167
2 "	7·522
$2\frac{1}{2}$ "	10·55
3 "	13·87
$3\frac{1}{2}$ "	17·48
4 "	21·36

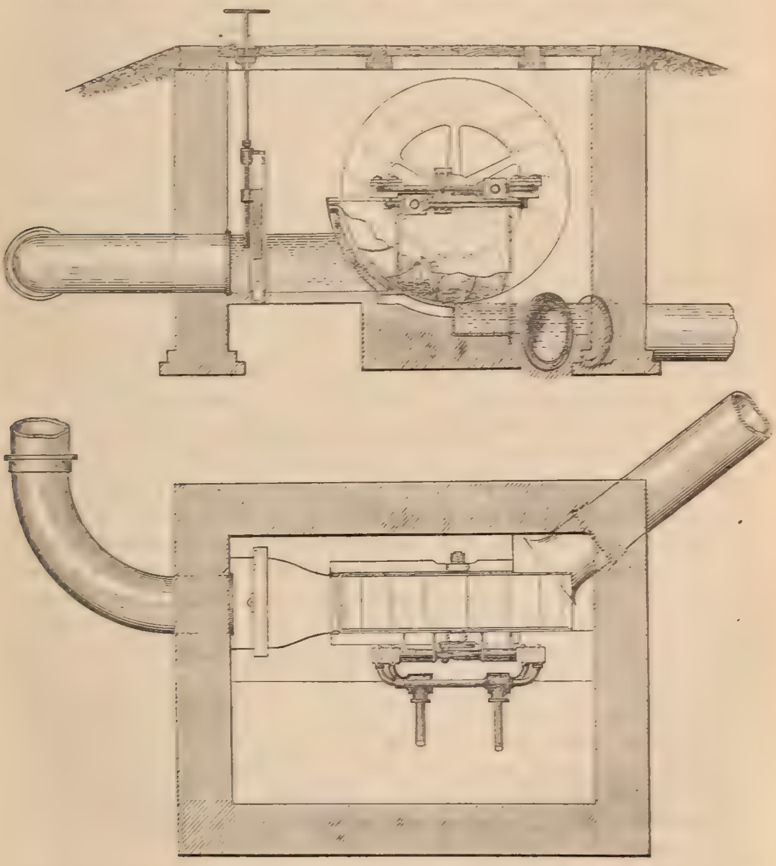
The gallons discharged per minute, multiplied by the length of the notch in inches, will give the volume of water passing down the stream per minute.

Suppose that the observed depth was $2\frac{1}{2}$ inches, and the length of the notch 28 inches. The discharge for 1 inch long and $2\frac{1}{2}$ inches deep by the table is 10·55 gallons per minute; then the discharge would be = 10·55 gallons $\times$ 28 inches = 295 gallons per minute, or sufficient for the contemplated supply.

* An illustration of this test is given in vol. xiv. of the 'Journal,' page 58.

But small streams are very often subject to great variations in the volume of water they discharge; it is necessary, therefore, to ascertain the past history of the brook, and determine how many days in the year the water will fail altogether, or be very deficient. Frequently the features of the county allow half the scanty flow to be dammed back by means of a weir

Figs. 4 and 5.—*Section and Plan of a Poncelet Undershot Wheel.*



placed across the stream, and the water so impounded at night at a higher level may be used for pumping in the day; but even that resource fails at times, and then the only alternative is to make the pumping machinery sufficiently powerful, and to provide storage room sufficient to take advantage of the abundant flow of water during wet weather.

For low falls, say 6 feet and under, and where the height to which the water has to be raised is more than fifteen times the fall, Poncelet Undershot Wheels are the simplest, cheapest, and most efficient. The wheels in question (Figs. 4 and 5) differ from ordinary wheels, in having the buckets or paddles rather deep in proportion to the diameter of the wheel, and curved in such a way that the thin stream of water entering at the bottom of the wheel runs up the blades a certain distance and then slides down again, in both operations imparting its energy to the wheel. In the form represented in the figures, the wheel is supported by a pair of cast-iron sides, united by a bottom piece, to which the proper form is given; the thickness of the jet is regulated by a sliding-plate curved to the form of the wheel, and which can be adjusted so as to proportion the volume of water flowing into the wheel to the work to be done. One of the side plates carries a pair of pumps, which are actuated directly by a crank fixed on the axis of the wheel, the whole arrangement being thus self-contained. The wheels are usually placed in a vault, or sunk in a brick-lined pit by the side of the stream; the water is led in and out by means of iron or earthenware pipes, and a regulating sluice is fixed and so arranged as to be opened by a turncock's key, without the necessity of entering the wheel-house. A valuable property of this kind of water-wheel is the comparatively high speed at which it runs; that speed should be such that the periphery of the wheel moves half as fast as the jet of water which works it. Thus a wheel 5 feet in diameter, worked by a fall of $1\frac{1}{2}$ feet, would make 18 revolutions per minute, and consequently moderate-sized pumps can be worked direct from the main shaft without the intervention of gearing. I have erected wheels of this kind successfully, where the fall was as low as 3 inches—in fact, a mere rapid stream; and in one interesting case, a chalk spring in the Essex marshes, having a fall of from 5 inches to 10 inches, works a Poncelet wheel 3 feet in diameter and $8\frac{3}{4}$ inches wide, actuating a pair of pumps $1\frac{1}{4}$-inch diameter and 5-inch stroke, raising $\frac{3}{4}$ gallons of water per minute 80 feet high, to supply a large homestead and gentleman's residence. A large tank made of concrete stores the water pumped during the night for use in the daytime.

The cost of these wheels and pumps ranges between 50*l.* and 80*l.* They require periodical oiling, and efficient strainers should be fitted to the intake so as to keep out weeds and rubbish.

Water-wheels of all sizes, and more especially those made for low falls, are greatly hindered in their action by backwater, that is, by the general rise in the level of a stream in consequence of floods, and as this rise frequently reaches an amount greater

than the diameters of the wheels, provision must be made for their stoppage during wet weather by securing storage room enough in the service reservoir, and these precautions are at times necessary, as I have already pointed out, in order to obtain clear and colourless water.

There are, however, hydraulic motors, which will work under moderate falls, and which are not affected by submergence, provided the fall remains unaltered. Turbines and reaction wheels belong to this class. A turbine consists of a wheel, formed of a pair of rings, between which are fitted paddles or blades, curved to a particular form. The wheel is usually mounted on a vertical axis and has the water admitted into it, either from above or from below, by means of a pipe, expanding into a pair of rings, the outer diameter of which is a little less than the inner diameter of the wheel, but similar to it in other respects, and also fitted with curved blades or directrices, by which the water flowing out gets a proper direction given to it, and forms a series of jets, issuing tangentially all round the inlet pipe, in the plane of the wheel. These jets impinge on the blades of the wheel, and by their impact cause it to revolve.

In one modification of this arrangement, known as the Jouval turbine, the water, instead of flowing at right angles to the axis, issues parallel to it, the revolving wheel being placed in line with the fixed ring of directrices. Motors of this kind yield a very good efficiency, for even small ones may be expected to give 60 per cent.

The reaction-wheel, or "Barker's Mill," as it is often called, is a very simple machine, and consists of a pair of hollow arms curved to a particular form, fixed to a spindle and capable of revolving with it. The water enters from one side in line with the axis, and, dividing into two streams, issues as a continuous jet from the two revolving arms which are caused to turn in the opposite direction to the jets, partly by the unbalanced pressure at the open ends, and partly by the reaction due to the water being forced out of the straight path, in which it would naturally flow, by the curved arms. These mills will yield about 40 per cent. duty. All the motors belonging to the turbine family work best when completely submerged; they also run at a high velocity, the best speed of the periphery of the wheel being, as in the Poncelet wheel, about half that due to the fall. Thus, suppose a fall of 4 feet and a wheel 2 feet diameter. The velocity acquired in falling 4 feet is 16 feet a second, hence the speed of the wheel should be 8 feet per second, and as the circumference is $6\frac{1}{4}$ feet, the number of revolutions would be $\frac{8 \text{ ft.}}{6\frac{1}{4} \text{ ft.}}$ = about $1\frac{1}{4}$ per

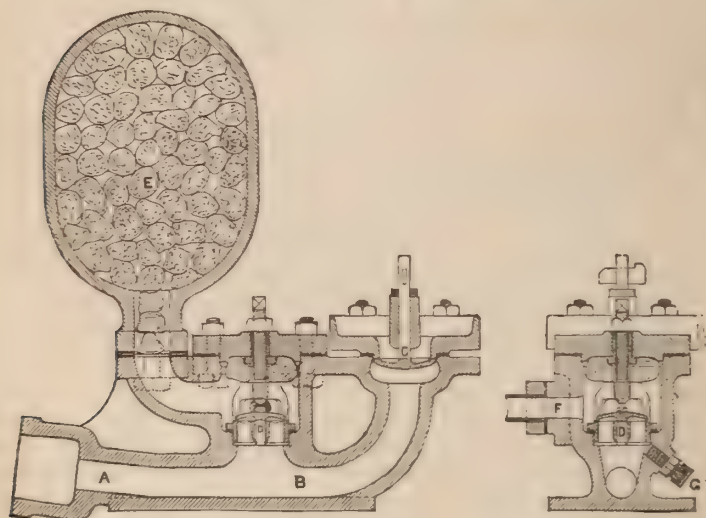
second, or 75 per minute. In consequence of the water issuing all round the ring, sufficient water-way can be obtained with wheels of small diameter, and hence the speed of revolution in this class of motors is very high. Pumps may be arranged, so as to be driven direct from the spindle by cranks attached to it, or the speed, if very high, may be reduced to a moderate amount by suitable gearing.

The dimensions and form of turbines depend so much upon the particular conditions under which they have to work, that it is impossible to give any general idea of cost.

Turbines occupying but a small compass, can frequently be arranged in vaults by the side of the stream, and so kept from frost and from disfiguring the landscape. They require careful attention in oiling, cleaning, and periodic adjustment, and cannot, on that account, be recommended where more simple motors can be used.

When the fall available is not less than 4 feet and the lift not more than fifteen times the fall, hydraulic rams are the best and cheapest water-raising engines to employ.

Fig. 6.—*Section of Hydraulic-Ram.*



The ram consists of an inclined injection-pipe, A (Fig. 6, which is inserted by the permission of the Royal Institution), which leads the water from a reservoir into a chamber B, which terminates in a valve C, opening inwards. Branching up from the chamber is a passage leading to a valve D, opening out-

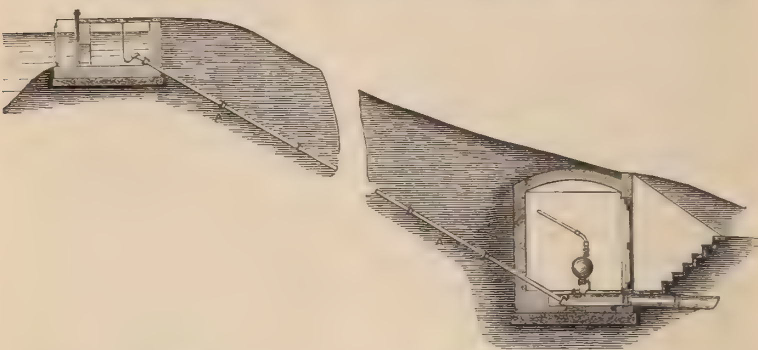
wards and communicating with a regulating vessel E, which is usually filled with air. Immediately beyond the inner valve is inserted a delivery pipe F, which is laid to the spot to which the water has to be pumped. The action of the ram is as follows:—The outer valve C, which opens inwards, is, in the first instance, held open, and a flow of water is allowed to take place through it down the pipe and chamber. The valve is then released, and is instantly shut by the current of water which is thus suddenly stopped, and, in consequence, delivers a blow similar to that produced by the fall of a hammer on an anvil, and just as the hammer jumps back from the anvil, so does the water recoil to a small extent along the pipe. This external aid must be repeated several times at first, starting a ram, till sufficient pressure is got up in the air-vessel to allow the working to go on automatically. During each stroke, first, a certain portion of water is forced by virtue of the blow through the inner valve D, opening outwards, into the air-vessel, and so to the delivery-pipe, and instantly afterwards the recoil causes a partial vacuum to form in the body B of the ram, and permits the atmospheric pressure to open the outer valve C, and re-establish a rush of water as soon as the recoil has expended itself. In this way a succession of rushes, stoppages, and recoils take place many times in a minute, a certain quantity of water flowing to waste from the outer valve C, and a smaller portion passing the inner valve D into the rising main.

One very important adjunct is the "sniff-valve" G. Some kinds of water absorb air very readily, especially when under pressure; hence in such cases the air in the vessel E would soon become absorbed, and the ram would cease to work for want of the elastic cushion, were it not for the sniff valve G, which is a very minute valve opening inwards. At the moment of recoil, when a partial vacuum is formed in the body B of the ram, a bubble or two of air is drawn in through the sniff-valve, and finds its way through D into the air vessel. It is important, for the efficiency of the ram, that the quantity of air admitted be as small as possible.

Sometimes it is convenient, in order to take advantage of a scanty supply of water in summer, to place a ram so low that it becomes covered by back-water in flood-time. A good ram will work under such conditions; but, if the water be of a quality requiring the addition of air, a sniff valve will be inoperative, because it will be submerged; in such cases the air vessel can be filled with ordinary bottle-corks, a stout grating being inserted between the neck of the air vessel and the corks. The constant variation of pressure, and the consequent movement of the corks, causes them gradually to lose their elasticity, so that they will

require changing from time to time. To make a ram work to the best advantage, it is necessary to adjust the stroke of the outer valve C to the particular conditions of fall and lift, and to effect this there is always a special provision on the spindle of the valve. The less the stroke of the valve, the faster it will beat, and the best point can be determined by measuring the quantity of water delivered under various lengths of stroke.

Fig. 7.—*Section of Reservoir with Injection-pipe fitted with Flap-valve.*



When the water supply is scanty, the stream should be dammed, and a good-sized reservoir (Fig. 7) should be made by the side of the stream for the injection-pipe A to start from. The upper end of this pipe is, in all cases, fitted with a flap-valve opening outwards, and provided with a chain, so that it can be opened or closed at pleasure. But with a scanty flow the supply would, in time, become exhausted, the outer valve C would refuse to shut, and the water would dribble away through the ram to waste, without doing any work. To avoid this, the flap-valve at the upper end of the injection-pipe is attached to a float, just buoyant enough to keep the flap up, when quite submerged, but not of sufficient floating power to lift it when closed. A second and more powerful float is attached to the valve by a slack chain, or by means of a sliding rod, so adjusted, that when the water rises to its full height, it will pull the valve open suddenly, allow the water to rush down into the ram, and set it going at once. As the water falls, the slack attachment of the large float allows it to sink without affecting the valve, which is kept open by the smaller float till the water reaches its lowest level again, and permits the valve to close.

The same object can be accomplished by means of a single float sliding up and down upon a vertical bar between stops

attached to it. The lower end of the bar is jointed on to a lever, attached to the valve, and the upper end to the horizontal arms of a bell-crank lever, the vertical arm of which is fitted with a counter-weight, and forms a "tumbler" arrangement, that is, it is free to move a certain distance on the axis of the horizontal arm between stops. As the water falls in the tank, the float slides down the rod till it rests on the lower stop; its weight then pulls the bell-crank lever over, and as soon as the upright weighted arm passes the centre, it falls over against a stop on the horizontal arm and depresses that without affecting the float, till the valve is closed and the ram stopped. As the water rises, the float travels up the rod to the upper stop, and by its buoyancy throws the upright arm of the bell-crank over on to the opposite side, where its weight holds the valve open till the water sinks again to its lowest level.

The duty which hydraulic-rams are capable of performing depends upon the fall, the rate of inclination of the injection-pipe, and the relation which the lift bears to the fall; but it may be taken at 80 per cent. duty at proportions of lift to fall of 4 to 1, down to about 50 per cent. for the highest ratio. The most useful size of ram has a 3-inch injection-pipe, and, while consuming a constant quantity of about 25 gallons per minute, will discharge according to the following table:—

Proportion of Lift to Fall.	Gallons delivered per minute.
4	5·
5	3·5
6	2·9
7	2·4
8	2·
9	1·7
10	1·4
11	1·2
12	1·1
13	0·95
14	0·85
15	0·75

As with pumps, the friction of the rising main must be added to the actual lift in estimating the quantity of water the machine will deliver.

Rams are made of various sizes, but they do not work well when very large, say, with injection-pipes more than 6-inch diameter. They use water, and raise it approximately in proportion to the area of their injection-pipes, that is, as the square of their diameters. Thus, for example, a ram with a 2-inch

injection-pipe will discharge, as compared with a 3-inch, as 2^2 is to 3^2; that is, as 4 is to 9. The water required to work it will therefore be $\frac{25 \text{ gallons} \times 4}{9} = 11$ gallons per minute, and the quantity raised when the lift is, say, 10 times the fall $= \frac{1\frac{1}{4} \text{ gallons} \times 4}{9} = \cdot 55$, or a little more than half a gallon per minute. It is best, for many reasons, when more water is required than one moderate-sized ram will supply, to arrange a battery of two or more.

Rams are generally placed in vaults made by the river-side (Fig. 7), so as to be entirely protected from frost. They will work for years with very little attention; they require no oiling, and the working parts wear very slowly.

The price of a 3-inch ram put up complete is about 35*l.*, including the vault in which it is placed.

When the falls exceed 30 feet, turbines of small power have to revolve at a destructive speed, and hydraulic-rams knock themselves to pieces very quickly; it is then necessary to have recourse to water-pressure engines. These are either rotatory engines, in appearance and structure very like ordinary steam-engines, and acting precisely in the same manner; or they are direct-acting pumping engines, in which the stroke is regulated by automatic valve-gear, worked without the intervention of rotatory motion.

The hydraulic-engine differs from a rotatory single-cylinder engine only in having the pipes, ports and passages much larger in proportion to the volume of the cylinder than is required for steam; this is in consequence of the greater density of water and the large amount of friction which results when it flows at high velocities. The slide-valves also have to be so arranged that the water can never be imprisoned in the cylinder, for water is incompressible, and if imprisoned, the engine must either stop or something must give way. As the motion of a piston is constantly changing from being stationary to a high speed, and then becoming stationary again, the water which flows into the cylinder partakes of the same motion; and therefore in order to avoid destructive shocks in the necessarily long supply pipe, it is desirable to place an air vessel close to the engine, and arrange means of keeping it properly supplied with air, if the water tends to absorb it, as is frequently the case.

The ends of the cylinders also should have small passages, covered by valves opening outwards, communicating with the pressure-pipe. These, in ordinary working, are kept closed by the pressure in the main; but if from any cause undue

momentary pressure should arise in the cylinder, the valves open and allow some water to escape, and so prevent disastrous strains. Rotatory hydraulic-engines may be used for every purpose to which a steam-engine can be applied, and they can therefore be used to drive pumps actuated by cranks. But when an hydraulic-engine is not required for other work besides pumping, it is best to adopt a direct-acting motor. Of these there are many varieties, but the most simple and satisfactory is one arranged on the duplex system. The machine consists of two hydraulic pressure-cylinders and two pumps, forming two pairs, placed parallel to each other, with a pump in line with a cylinder, with their piston-rods connected, so that the pressure on the hydraulic-cylinder is communicated direct to the pump. The cylinders are fitted with ordinary hydraulic slide-valves, without lap, and the pumps are of any variety of the double-acting kind. The valve motion consists merely of a pair of unequal armed levers, having fixed fulcra in the bed-plate which carries the cylinders, and connected so that the long arm of one lever is connected to, and worked by the piston-rod of the right-hand engine, while the short arm actuates the slide-valve of the left-hand cylinder. The other lever is arranged in a similar manner to the left-hand piston-rod and the right-hand valve. The effect of the arrangement is, that as one piston makes a stroke it admits the water pressure to the other cylinder, and *vice versâ.* These pumps are extremely simple and durable, requiring very little attention; they may be depended on to do 70 per cent. duty.

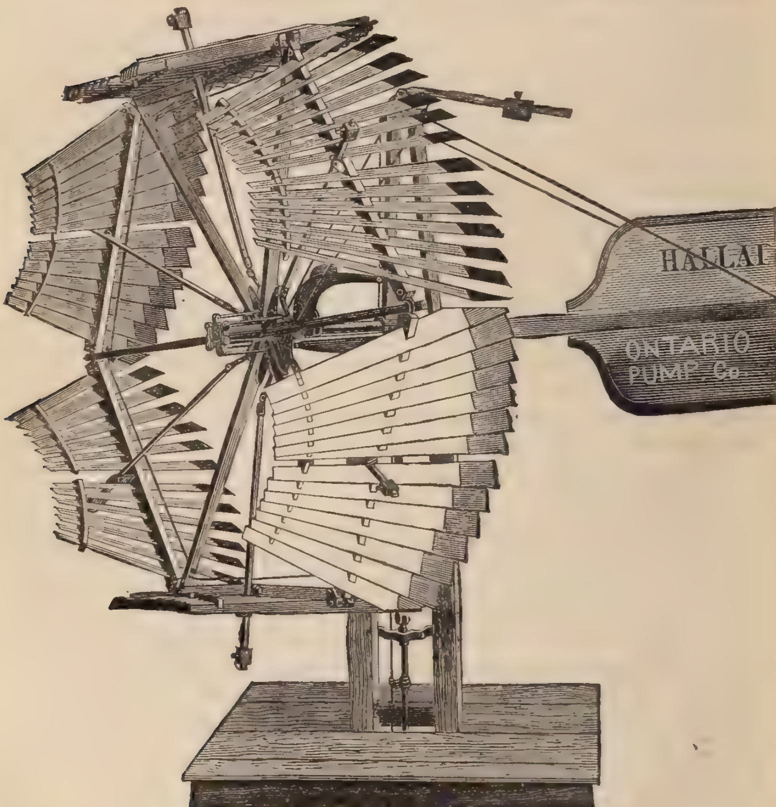
In dealing with high falls, the pipes are necessarily of considerable length; so in the case of turbines, as well as of hydraulic-engines, not only must the friction of the rising pipe be taken into account in estimating the power, but the friction of the supply-pipe of the motor must be ascertained, and its value deducted from the apparent fall. These calculations are not difficult, yet it would be prudent in these cases to obtain professional advice. The size and proportions of pressure-engines depend so much on the circumstances of particular cases that it is impossible to give any general idea of their cost.

It frequently happens that water motors have to pump different water from that which drives them. Thus in the case of rivers, liable to become turbid or discoloured at times, it is often possible, when the strata are sufficiently open and permeable, to construct a natural filter, by digging a trench parallel to the river, and a few yards from its margin, filling it with broken stones, or laying in common drain tiles, and then filling the trench up again. A small sump or well is constructed at one part of the trench, and the suction-pipe of the pump is led into it. If the soil be open and porous, and the trench made

large enough, sufficient water will filter through to give a uniformly good supply. Sometimes the porous strata are too deep for a trench, and in such case a well may be sunk and made to serve the same purpose.

Hydraulic-rams are constructed specially so as to pump a different water from that which works them. To accomplish

Fig. 8.—*Elevation (sails closed) of the Halladay Windmill.*



this, the inner valve D (Fig. 6) is replaced by a small cylinder, fitted with a well-packed piston of very short stroke. The piston rests on stops at the bottom of its stroke, and is further pressed down by a light spiral spring. The passage leading up to the air-vessel is fitted with two valves, one over the other, the space between being connected with that over the piston above described. The two valves open upwards, and the suction-pipe from the pure water source is connected to the space under the

lower valve; the delivery-pipe issues just below the air-vessel over the upper valve. When the ram is in action, the piston, which has replaced the valve D, works up and down like that of a pump of short stroke; each blow sends it up, and each recoil sucks it down. In the down-stroke it draws up the pure water

Fig. 9.—*Elevation (sails open) of the Halladay Windmill.*

from the supply, and in the up-stroke discharges it into the rising main. Rams so arranged will not suck up water more than a very few feet; it is therefore desirable to arrange for the pure water being as near the level of the ram as possible. The height to which they will suck depends upon the strength of the spring which forces down the piston.

One source of power which has unjustly fallen into disfavour is wind. For such purposes as pumping, where, by means of moderate-sized storage tanks, provision can easily be made for calms, and where irregularity of motion is of no consequence, windmills are of the greatest value, especially if they be so constructed as to be automatic in the adjustment of their sails, both with regard to the direction of the wind and its force.

It has been found that windmills, in this country, can be worked for about one-third of their time, hence their power and the capacity of the pumps should be three times greater than that which would be required to furnish the mean supply.

A farmstead such as that of the Aylesbury Dairy Company, for example, requiring 2430 gallons per day, should have a pump capable of raising three times the amount, or $2430 \times 3 = 7290$ gallons per day, or 5 gallons per minute; and the storage tank should hold at least a fortnight's supply, or 34,000 gallons.

The practical difficulty in making use of wind-power for domestic purposes lies in the automatic adjustment, which is essential where the apparatus is to work without supervision, and at small cost for repairs. Many varieties of windmills have, from time to time, been introduced with this object, but few of them appear to answer this purpose satisfactorily, mainly on account of the large number of joints and moving parts which the several systems have rendered necessary. Windmills on Halladay's system, however, which are largely used in North America, and specimens of which were exhibited by the Ontario Pump Company at the Indian and Colonial Exhibition last year, seem to present advantages of design and construction which must recommend them strongly.

The sails are of the disc kind (Figs. 8 and 9); but instead of being composed of a large number of individually moveable radiating sail-boards, they are arranged in six or eight groups, each group turning on pivots in the plane of the disc, and at right angles to the mean radius, so that when it is desired to reduce sail, the ends of the boards are presented to the wind, and not the edges, as in the common arrangement; the effect being that less surface is presented to the wind, and the number of joints and sets of mechanism actuating them is reduced to six or eight. In addition, the sections are so hinged, that the centrifugal force due to increased speed of rotation helps to turn the sail-boards out of the wind, and so reduces the effective sail-area, thus giving the windmill considerable uniformity of speed in varying winds, and minimising the possibility of injury from heavy gales.

The pivot of each section is connected by rods and bell-cranks in a simple and substantial manner to a disc, sliding on

the main-shaft of the sail-wheel, and the position of this disc, and therefore of the sail, is regulated by a bell-crank lever and balance-weight, which can be controlled by means of a wire by the attendant on the ground, or by a float in a water-tank, or by a loaded hydraulic-cylinder in communication with the rising main of a pump when the mill is used for lifting water. The weight on the regulating lever is set to yield at any desired pressure or speed of wind. The sail-wheel is mounted on a fixed turret, of suitable height, usually formed of open woodwork, and is turned to the wind by a powerful vane, which also serves to balance the weight of the wheel.

A wind speed of 18 miles per hour is taken as the standard for estimating horse-power, and under such conditions a sail-disc 8 feet in diameter will give one-man power, or say 2000 foot lbs., per minute. Windmills have been constructed of 60 feet in diameter, estimated to yield 40 horse-power.

The following table gives the size of mills required to raise various quantities of water to a height of 25 feet:—

Diameter of Sail-Wheel.	Revolutions per Minute.	Water raised 25 feet per Minute.
feet.		gallons.
10	50	10
12	48	15½
14	44	25½
16	40	67
18	37	89
20	34	99
22	32	107
25	30	217
28	28	368
30	26	524

For greater lifts the size of the windmills must be increased in proportion. Thus, for example, a 12-feet mill will raise 15½ gallons 25 feet high; but if it is required to be lifted four times the height, or 100 feet, it would need a mill of four times the power, or one capable of raising 62 gallons 25 feet, which, according to the table, will have a 16-feet sail-wheel.

The prices of the mills range from 16*l.* for the 8-foot wheel, to 120*l.* for the 30-foot, but this does not include the derrick or turret, the cost of which depends upon its height, and therefore on the locality. The cost of fixing cannot, for the same reason, be defined.*

* Further information respecting windmills will be found in Mr. Coleman's report on the agricultural implements in the Philadelphia Exhibition, in volume xiii. of the 'Journal,' 1877, page 67, and in Mr. Wheeler's paper on the storage of water, in volume xiv., 1878, page 47.

When water- and wind-power fail, recourse must be had to heat engines, of which three kinds are available—steam-, gas-, and hot-air engines. Where these have to be employed, it is best so to arrange the size of the engine and the capacity of the storage-tanks that a sufficient supply of water may be pumped up in about five hours' work every second or third day. The reason for this is, that heat engines require more or less supervision all the time they are at work, and hence the cost of the attendant, which would be no greater for a large than for a small engine, would outweigh all other expenses, unless the hours of work are limited as much as possible. In the case of a homestead requiring a supply of 2000 gallons per day, the rate of pumping, if the machinery be worked five hours every third day, would be $\frac{2000 \text{ gallons} \times 3 \text{ days}}{5 \text{ hours} \times 60 \text{ minutes}} = 20$ gallons per minute; and if the lift, together with the friction of the pipes, be 166 feet, then the horse-power required will be

$$= \frac{20 \text{ gallons} \times 10 \text{ lbs.} \times 166 \text{ feet}}{33{,}000} = 1 \text{ horse-power.}$$

The pumps, with their motor, may be placed in any convenient situation if the water to be pumped is near at hand, and not more than 20 feet below the level of the pumps; but if the source of supply be at a distance, considerable care must be taken in the arrangements. Long suction-pipes are objectionable, because of the difficulty of laying them quite free from leaks, and leaks are very prejudicial to their efficiency. In addition, the force available to cause the water to flow in a long suction-pipe is limited to the atmospheric pressure, which corresponds to a column of water 34 feet high, that is to say, a pump capable of creating a perfect vacuum would suck water up to that height; but a perfect vacuum is never attained in a pump, hence it is not well to count upon more than 22 feet head, and therefore the actual lift of the water and the head of friction in the pipe, taken together, must not exceed that amount.

Suppose the water to be at a distance of 1000 feet, the suction-pipe to be 2 inches in diameter, and the quantity of water to be drawn through to be 20 gallons per minute, then from our diagram (Fig. 3) we find that 20 gallons per minute through a 2-inch pipe will require a hydraulic gradient of 1 in 71, hence the friction of the pipe will be $\frac{1000 \text{ feet}}{71} = 14$ feet, and consequently the actual lift of the water must not be more than 22 feet—14 feet = 8 feet. As the motion of the water in the pumps is generally intermittent, the suction-pipe close to the pump should be fitted with an air-vessel about ten times the

capacity of the pump-barrel; this will enable the water to flow continuously into the air-vessel while the pump is taking the water intermittently, and ram action in the suction-pipe will then be avoided. The lower end of the suction-pipe should be fitted with a foot-valve, which will retain the water in the pipe when the pump is not running, for without such a valve the air will be gradually drawn in through the glands and valves of the pump, which are rarely absolutely tight, and so the charge will be lost, and much time will be spent in restoring it every time that the engine is set to work.

It is hardly necessary for me to say anything about the ordinary types of steam-engines which are available for driving pumping machinery, but I may remark that the boilers of such engines should have large furnaces, allowing of a thick charge of fuel, and they should be provided with well-fitting furnace and ash-pit doors and smoke-dampers, by means of which the rate of combustion can be regulated. The attendant gets up steam, sets the engine to work, makes a good fire, and then adjusts the ash-pit door and damper, so that the fuel will burn at the proper rate to generate the quantity of steam necessary to keep the engine running at a steady pace. Experience soon teaches him how to do this, and he is then able to leave the machinery for an hour at a time, or even longer, to attend to other duties. With a small furnace, imperfectly fitted, this would be impossible, on account of the frequent firing required.

Small steam-engines are usually made non-condensing, but there exists a very excellent form of condensing engine made by Messrs. Hathorn, Davey and Co., of Leeds, called the "Davey Motor," which I can strongly recommend for pumping purposes. A full description of this engine will be found in volume xxi. of the 'Journal,' pages 34 and 35, and a further description, together with the experiments made with it at Preston, on page 707 of the same volume. It will be seen that the fuel consumed was only about $6\frac{3}{4}$ lbs. per actual horse-power of work done, and the boiler, when charged, will run for several hours without any attention.

Suppose the pump to do 70 per cent. duty, the consumption of coke per horse power of water lifted would be $\frac{6\cdot75 \text{ lbs.}}{\cdot7}$ $= 9\cdot64$ lbs., and for five hours' work about 48 lbs.; so that three days' supply of 2000 gallons per day could be obtained by the consumption of 48 lbs. of coke for actual work, and about 24 lbs. for getting up steam, a total of 72 lbs., costing about eightpence, or about $1\frac{1}{3}$ pence per 1000 gallons.

The Davey motors being essentially condensing engines require a supply of water at the rate of about $1\frac{2}{3}$ gallons per

effective horse-power per minute. If this can be obtained from a river or lake there is no difficulty in the matter; but if no such source be available, then an injection-tank must be provided. The engine in the case above mentioned, doing 1 horse-power of water lifted, will have to give out 1·43 effective power, and will need 143 gallons of injection-water per hour, and therefore 715 gallons during the five hours it is working; this will require a tank about 5 feet 6 inches square, and 4 feet deep. The temperature of the water will rise about 40°, but there will be plenty of time for it to cool down before the water is wanted again. The pipes connecting the tank with the engine should be so arranged that the hot water should flow on to the top, and the cold water be taken from the bottom, by which arrangement the waters of different temperatures will be kept separate, and a supply of cold injection will be assured all the time the engine is running. The tank may be a pond or reservoir of any description, or an iron tank placed, if possible, out of doors, because the steam arising from the hot water may prove a nuisance indoors; the water will also cool quicker in the open air.

The cost of the motor is very moderate, and ranges from 55*l.* for half a horse-power, to 115*l.* for a three horse-power, fixed ready for working; and it is an important feature in these engines that they are absolutely safe, because the boilers are practically open to the air, and the management of them may therefore be safely intrusted to women and totally unskilled persons.

Caloric engines have been greatly improved of late, and are now produced in a form which renders them applicable, where moderate power is required. In vol. xii. of the 'Journal,' page 596, and in vol. xiii., page 282, will be found complete descriptions of one of the most successful of these motors, that made by Hayward, Tyler, and Company, of London; and in vol. xix., page 583, the official reporter on the implements exhibited at York mentions that no fewer than eight firms exhibited hot-air engines, and that their fuel consumption had been reduced to an amount as low as 2½ lbs. per indicated horse-power per hour. The advantages of the hot-air engine are, that very little fuel is expended in getting it to work, for although the fire has to be lighted about half an hour before the engine will work, yet it will continue running some 20 minutes after the fuel is all consumed. It has no boiler of any kind and requires but little water to cool its working parts; it therefore occupies very little space, is quite safe, and needs no store of water for injection. The disadvantage is, that the intense heat of the furnace acting on the dry metal of the cylinder tends to burn it out

somewhat quickly, but I am informed that, as now constructed, the defect I have pointed out is no longer a serious one, and that the parts liable to be burnt out are capable of being very quickly and cheaply renewed.

Working under the same conditions as the steam-engine last described, namely, raising 2000 gallons per day 166 feet high in 5 hours, assuming 50 per cent. duty and a consumption of 4 lbs. of coke per indicated horse-power per hour, or 8 lbs. per horse-power of water lifted, the consumption of coke will be 40 lbs. for the whole time that the engine is running, representing a cost of $4\frac{1}{3}$ pence for raising 6000 gallons, being at the very low rate of less than $\frac{3}{4}$*d.* per 1000 gallons. The price of the smallest-sized motor, fixed, is about 56*l.*, and larger sizes are proportionately dearer.

The last source of power I will allude to, but by no means the least important, is ordinary illuminating gas, whether derived from the distillation of coal, oil, or petroleum.

The gas-engine is now so well known that it is hardly necessary to describe it, but in vol. xiv. of the 'Journal,' pages 149–151, will be found a detailed account of the "Otto" silent gas-engine, the best of this class; and again, in vol. xv., page 128, is another notice of the same engine, together with a description of two other machines belonging to the same category.

Gas-engines of very small power are now made, and in places where illuminating gas is to be had their adoption presents no difficulties whatever, and even in country districts gas can be manufactured from oil at very low cost. In vol. xxii. of the 'Journal,' page 561, the official reporter on the implements exhibited at Norwich states that the "Watford" Oil Apparatus, which was there employed to generate gas for six "Otto" engines, produced excellent illuminating gas for 1*s.* 9*d.* per 1000 cubic feet. There are many methods of generating suitable gases, such as simply drawing air through gasoline without the application of heat, but probably the gas derived from the distillation of oil will prove the cheapest. Messrs. Crossley Brothers manufacture "Otto" gas-engines giving off as little as 1 horse effective power, and this "5 man-power" engine, as it is called, costs about 52*l.* fixed, while an engine giving 4 horse-power costs about 156*l.*

The consumption of gas, even in small engines, may be taken at 25 cubic feet per indicated horse-power per hour, and supposing the duty done in pumping to be only 50 per cent., the consumption of gas per horse-power of water lifted would be 50 cubic feet per hour, and in the case we have been investigating the 6000 gallons would be raised 166 feet in five hours by the

consumption of 250 cubic feet of gas. Assuming it to be worth 2*s.* per thousand cubic feet, the cost would be 6*d.*, or only 1*d.* per thousand gallons. The great advantages of gas-engines are, that they occupy little space, they can be started at a minute's notice, they require very little water to cool the working parts, and neither time nor fuel is lost in getting them ready for work.

In many instances it would be convenient to have the motor and pump combined in one machine, and the makers of the motors would readily furnish such combinations; but it is very commonly more advantageous to arrange the pumps separately and drive them either by means of a belt or by gearing from the crankshaft of the motors. One reason for preferring the separate arrangement is, that small motors generally run two or three times as fast as it is desirable to work pumps, hence some means of reducing speed is necessary.

Wells.

The last sources of supply to which I will allude are wells. They are the most common, and at the same time, for small supplies, the most objectionable and dangerous.

The reason for this perhaps startling opinion is, that the water in wells is practically stagnant, and the air over the water is frequently so deficient in oxygen that it will not support combustion, hence there is little or no self-purifying power in the water, and if it become contaminated it cannot free itself from the evil, and while water has small power of self-purification it is peculiarly liable to pollution. Wells are generally lined with very open brickwork, by no means water-tight; they stand in the midst of buildings, sunk in ground, the upper strata of which are often deeply impregnated by organic contamination proceeding from the usual surroundings of a dwelling-house or homestead, and such contamination is washed down in wet weather, some of it finding its way into the well. Sewers frequently pass close to wells, they are rarely water-tight, and leakage from them also gravitates to the lowest point, that is, the well, and cases have even occurred where negligent or indolent workmen and unscrupulous contractors have actually allowed drains to discharge into wells, and the disgusting offence has not been discovered till the outbreak of an epidemic has directed attention to the water-supply. In the case of draw-wells, much water is slopped about all round the well, becomes contaminated, and finds its way back again. Dogs, cats, rats, mice, domestic fowls, birds, and all manner of insects and creeping things fall in, decay, and become gradually dis-

solved by the water without the users of the well suspecting what they are drinking. Again, cesspools are very commonly sunk in close proximity to wells, their linings are by no means water-tight, in fact they are purposely made permeable in order that the liquid-matter may soak away, which it usually does as intended, and thus finds its way into the adjacent wells. I know instances where the water in wells and cesspools rises and falls with the tide of the adjacent river or sea, showing that there is complete communication, and yet the well-water continues to be used until the outbreak of an epidemic calls forcible attention to the matter.

Wells, however, are often the only means, except the rain, by which a water-supply can be obtained, and in such cases precautions should be taken to prevent contamination. If the upper strata through which the well is sunk be porous, the lining should be of iron, or of substantial brickwork laid in cement, and continued down well into an impervious stratum. The bucket and windlass, which implies an open top, should be abandoned for a pump, placed in any convenient situation, which can be done when the water is not more than 24 feet below the surface, and the top of the well should be domed over, or securely covered in. When the water is at a greater depth below the surface, the pump must be placed down the well, which should be securely covered, and the ground round it should be raised so as to give a good fall away in every direction, and the area immediately about the well should be paved or cemented. If the pump deliver at the well, a water-tight drain should be laid to carry the slops away, and especial care should be taken to place all drains and cesspools as far away as possible.

The water in most wells varies a good deal in level according to the season of the year, and as this variation frequently exceeds 22 feet, it becomes necessary to place the pumps at so great a depth, that when the water is high they are completely submerged. In such cases special precautions must be taken to render the pump-barrels and foot-valves accessible. The working-barrels should be prolonged upwards above the highest water-level by means of "stand-pipes," slightly larger than the barrels in diameter, so that the buckets and foot-valves could be easily drawn up through them, and the barrel-covers and glands should be placed on the tops of the stand-pipes so as to be accessible at all times. The pumps and their stand-pipes should be suspended from girders placed above the water level, so that, even in the case of a total break-down, they can be released and drawn out without the aid of a diver, or the necessity of pumping out the well. For the most part, however,

derangements only affect the packings of the buckets and the valves. In such cases the bucket can be drawn through the stand-pipe, and the foot-valve, which must be arranged for the purpose, can be hooked up and drawn out through the barrel and stand-pipe in the same way. The arrangements described are very costly, but are indispensable if a trustworthy supply is to be assured.

Pumps, suitable for deep wells, can be made single, double, or treble; the last are the best, because they deliver with the greatest uniformity, and work most smoothly. They can be worked by any of the motors I have described, either direct or through the intervention of belts and gearing.

So much depends upon the circumstances of each case, that it is impossible to give any useful figures as to the cost of deep-well pumps.

With respect to the prospects of finding water in any locality, the geological features of the county must be studied, and above all, as much information as possible must be obtained as to existing wells in the neighbourhood. With the aid of an ordnance map it is generally possible to reduce the water levels in the wells to the ordnance datum, when it will be seen whether the surface of the subterranean water has any general slope, and, when that is ascertained, the depth at which water is likely to be found in any locality may be estimated with some confidence.

It is beyond the scope of this paper to discuss the geological features favourable to finding water. Local knowledge will give ample information as to the prospects of sinking shallow wells; deep ones are too costly and too uncertain to be resorted to, except in cases where it would be worth while to obtain competent professional advice.

Some wells of scanty yield yet provide sufficient water at an average rate during the 24 hours, but to avoid incessant pumping they should be sunk deep enough and should be made of sufficient diameter to hold three days' supply, by which means the pumping engines need only be worked at the three days' interval. The cost of wells depends upon the depth, the nature of the ground and the price of bricks—about 30*s.* per foot deep may be taken as an average; but there is usually no difficulty in getting local well-sinkers to contract for them.

I have endeavoured in this paper to lay before the readers of the 'Journal' the various means by which a good supply of water can be assured in almost any locality. Any one standing in need of such provision will be able to form an opinion as to the best source to go to, and the most advantageous means of working to adopt; then, having come to a conclusion, he can

apply direct to those manufacturers who supply the class of machinery required. Such a course, I think, is likely to prove more satisfactory than seeking advice in the first instance from the makers of some special class of motor or pump, who will naturally be prone to recommend their own special wares, possibly in ignorance of other more excellent ways.

The 'Journals' of the Society afford, as the perusal of this paper will demonstrate, a vast fund of information on matters connected with this subject; and the annual shows give unrivalled opportunities for making inquiries into the latest improvements in water-supply machinery and motors, and for obtaining advice from the engineers or judges. I have confined myself entirely to the question of water-supply, but the choice of a motor will depend very much upon whether power is required for other purposes about a house or homestead. Thus, for example, dairy work, chaff- and root-cutting, crushing, grinding, &c., can be performed before or after pumping. Electric lighting is now coming into great prominence, and may often determine the kind and power of motor to be adopted. Again, the Davey motor yields a supply of warm water which may often be useful, and can, for example, be applied to warming buildings, greenhouses, and other purposes, thus effecting a considerable economy.

Perfectly wholesome water is often so much coloured that it is unfit to be placed on the table, and in such cases the domestic filter should be used. Dr. Voelcker, in the paper already referred to, describes several filters, and among them he draws especial attention to the Bischof spongy iron filter, which alone possesses the quality of permanence, that is, the water passing through it will always be benefited, not only in appearance, but in respect to chemical purity, no matter how long it may have been in use or how choked the iron may have become. In Vol. XX. of the 'Journal,' page 681, will be found a paper on purification of water by iron, which I had the honour of contributing, and in which the Bischof filter is figured and described. Inasmuch as the office of all filters is to remove impurities from water, it is evident that those impurities must collect in the filters, and hence it follows that periodical cleaning or renewal of the filtering material is absolutely indispensable, and this is especially the case in the charcoal family of filters, in which neglect of this duty may render filtration not only useless; but actually harmful.

III. *The Agriculture of Pembrokeshire.* By W. Barrow Wall, of Pembroke.

Prize Essay.

Introduction.

The past literature on this subject, so far as it has come under my notice, does not seem to me very satisfactory, as there has been so much copying by one writer from another that very little original matter remains. The Royal Agricultural Society having invited an essay on the agriculture of the county without restricting the writer in any way, I shall endeavour to record what has come under my observation during nearly twenty years, and avoid quoting from former works as much as possible.

In dealing with this subject, my object will be to point out the nature of the soils with their varying qualities, and, after cursorily detailing the customary systems of the county, to suggest, to the best of my ability, in what directions the systems may be modified to advantage.

That there are in Pembrokeshire farmers thoroughly versed in the most approved and advanced systems of modern agriculture is well known to all who take an interest in the subject, and I am only too conscious of the fact that many of these gentlemen, were they disposed, could deal with the subject in a manner that would entirely eclipse my humble efforts.

Area, Population, &c.—The county of Pembroke, comprising some 400,000 acres, and with a population of rather more than 90,000, projects into St. George's Channel. It is wave-bound on the north, west, and south, as a consequence of which, together with the influence of a portion of the Gulf Stream, which wends its way south of Ireland, the climate is usually very temperate. In conformation the county varies much, and although the highest part is 1754 feet above the sea-level, the face of the county has, generally speaking, an undulating, rather than a mountainous appearance, the series of hills becoming higher and higher as they retreat from the coast until the culminating point, called Precelly Top, is reached in the north-east of the county. The coast is formed for the most part of majestic cliffs and headlands. Milford Haven separates the extreme south-west almost entirely from the portion north of it.

The county is extremely rich in a botanical sense, and the verdure extends to the top of the Precelly Mountains; ferns, gorse, and heather flourish most extensively, but trees, except in

some sheltered valleys, and where plantations have been formed in recent years, are almost entirely absent; as a consequence, the county has a bare, inhospitable appearance. From the evidence of various sources, there is reason to suppose that the county was not always so bare of trees; and, again, as proved by recent plantations, trees flourish wherever there is shelter from the south-west. It is curious how the trees and hedges lean right away from the south-west; this circumstance seems to arise not so much from the pressure of wind as from the prevalence of south-westerly gales in the spring, just as growth commences, when the strong sea-air destroys the tender shoots on that side of the tree.

Geology.—On referring to the geological outline of the county (Fig. 1), and commencing at the most southerly part, we have a portion which indicates limestone; next comes a part indicating old red sandstone; then another strip of limestone; again, another of red sandstone; and then a third of limestone. A considerable portion of red sandstone is seen to the north of Milford Haven, and smaller strips in one or two other parts, as well as some limestone in the neighbourhood of Narberth. Next we come to some small strips bordering the red sandstone, and farther north a very considerable portion of the county representing the Silurian and Cambrian formations. The black strip which extends across the county from Saundersfoot on the south-east to St. Bride's Bay on the west, indicates the coal-measures; and this formation is fringed by millstone grit of irregular width in nearly its whole extent. The black bands which commence as far south as Skomer Island, occupy a strip at St. David's, and to some extent show over a large portion of the north of the county—indicate trap-rock.*

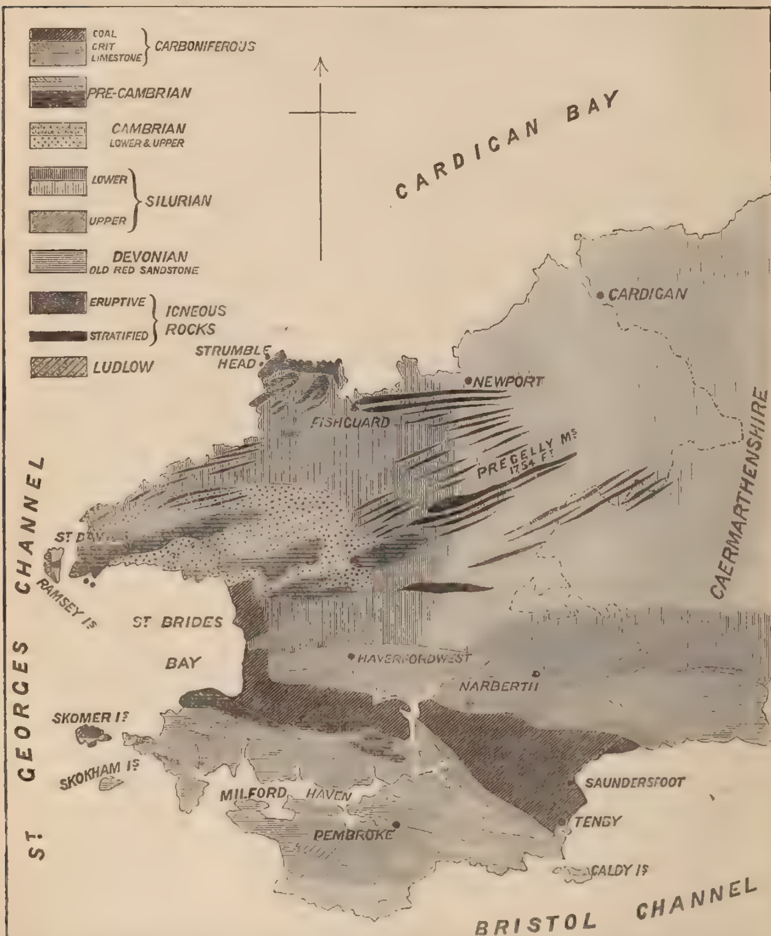
Soils. — The soils over these formations vary extremely. Every farmer knows the qualities of a limestone soil, with its sweet pastures—the delight alike of the dairyman and the grazier. These valleys are no exception to the general rule, being without doubt the best land in the county. But limestone districts have some disadvantages, and one of these is the scarcity of springs of water; this has been much felt on the part nearest the coast, and is being remedied by conveying water in pipes from the adjacent ridge of red sandstone. Another disadvantage of these localities is the proximity in certain places of the rock to the surface.

The red sandstone tracts are chiefly in ridges, running nearly east and west. This stratum forms anticlinals, varying up to

* Trap-rock. This word is used because it is more commonly associated, in agriculture, with such soils, and is meant to include all rocks of a granitoid, micaceous, gneissic or felsite nature.

some 300 feet above the sea-level. Generally speaking, this soil is fairly good and useful, though in places very shallow. One great advantage of the red sandstone is the abundance of springs of good water which it contains. Very usually where the two

Fig. 1.—*Geological Outline of Pembrokeshire.*



formations meet, there will be a band of clay, which varies in thickness, over which the water springs, and which is frequently a cold space between the two well-drained soils. These red soils are generally considered to be of a hungry nature, and to require frequent manuring. It is surprising how soon this land

improves under good treatment and high feeding of the stock on it. The Silurian and Cambrian formations, which occupy so large a part of the county, vary very much in different localities. A large district from Haverfordwest to Narberth, and north of this line, and various tracts to the north-east of the Precelly Mountains contain a deep, fertile, clayey soil, that forms excellent pastures, and formerly yielded good crops of wheat. In other places, again, there are many boggy, cold patches of little value ; at the higher levels there are extensive tracts of land with a thin peaty soil, which frequently carry little but heather, gorse, fern, and coarse grass ; again, where veins of slate and rab * appear, the soil will be usually well drained, and is often very good, especially if trap-rock adjoins. Slate-quarries are worked in the Precelly Mountains, and at one or two places between St. David's and Strumble Head. Wherever the trap appears, there is, as a rule, good soil ; this trap-soil is very stony, in fact, in some fields the stones are so thick, that it is almost like a shingle-beach to plough, and the accepted version is that the stones keep the soil open, and, being of a "sweaty nature," keep the roots moist. There is another reason why this trap-soil is so fertile, and which is not generally known by farmers, viz., that, according to the varying proportions of lime, magnesia, potash, and soda, some of the constituents of trap, so will the fertility vary. The presence of these saline matters explains the fertility of the soil, formed chiefly from these rocks decayed, and also the "sweaty nature" of the stones. These traps are in many places, especially at St. David's and along the coast to the north, very prominent objects ; here and there they rise in enormous beacons to the extent of some 500 or 600 feet above the sea-level. The ploughed field will extend up the slope of these, so long as there is sufficient soil. On these soils the best quality of barley in the county is grown ; and of such soils it is easy to believe a common legend, which relates how a farmer—recently arrived in such a district—picked up the stones, and carted them out of his field, for the sake of tidyness, and, as his crop failed, he carted them back again, for the sake of fertility.

The soils over the coal-formation and the millstone-grit are the least productive in the county—not from the absence of the elements of fertility, but because they contain elements poisonous to plant-life. There are in these formations frequent veins of blue, retentive shale, which with the present arrangements are almost unworkable. Nevertheless, fair crops of oats, barley, and roots are got from some parts of this tract, but drainage

* Rab—a local name for broken or imperfect clay-slate.

and the subsoil plough are required over a considerable part of it. The coal itself is anthracite, and some of the seams are of the finest quality for malting, brewing, and distilling purposes. Thousands of tons are sent to Burton-on-Trent and other brewing centres, as well as to the large distilleries of Ireland and elsewhere. Thus, possibly, the coal-measures of this county benefit agriculture indirectly. The undulating conformation, together with the comparative absence of very stiff clays, combine to dispose of the rainfall so satisfactorily, that there is not much bog-land; nor does the surface get flooded to any great extent in wet weather.

The absence of an excess of alumina is shown also by the soil not being of a very adhesive nature, and it is seldom that there is much difficulty in working the land.

Climate and Rainfall.—The weather is usually wet in January and the first part of February; then a dry period occurs, perhaps to the middle or end of March; April and May are generally rather cold, with easterly winds and variable rainfall; fine weather, with occasional heavy showers, prevails during June, July, and August; in September, usually a decided break comes, gales of wind with rain; after this equinoctial disturbance the weather is generally for a month or so the most delightful of the whole year; and often the fine bright days, with occasional fogs, extend on well into December. Severe frost is not common; a light hoar in October and November, and again in April, often make up the sum total. The rainfall is pretty evenly distributed over the year, and, though sufficient, is not excessive; the average for the greater part of the county is from 40 to 45 inches, and about 5 inches more for the high land.

Roads, Fences, &c.—The roads of a county have a close connection with its agriculture, and those of Pembrokeshire are, when taken as a whole, fit to compare in soundness and cleanness with any. Off the turnpikes they are generally rather narrow, but the limestone of the south and the igneous rocks* of the north make splendid roads. In the wettest weather they are not puddly, nor in the driest dusty, as compared with roads on the oolite or lias. The fences predominating are banks formed of sods and soil, or sods and stones, and sometimes these are surmounted with thorn or gorse; in the rocky parts stone and earth, or dry stone walls do duty. Large rivers there are not, but small streams are innumerable, and altogether the county is exceedingly well watered.

* Igneous rocks: it is intended here to refer to the harder of the rocks included under the general term "trap."

Holdings and Rent.—The size of holdings varies extremely, though the greater number range from 100 to 300 acres; the tendency of recent years seems to be for the size of the holding to increase. Rent, of course, with such varying soils, is extremely diversified, and ranges from 5*l.* down to 1*s.* per acre, though probably the greater number of the farms are rented at from 10*s.* to 25*s.* per acre. Fifteen shillings per acre is probably about the average for the county. More than two-thirds of the workable land is under grass, either as permanent pasture or in rotation. In recent years the low price of corn has caused some thousands of acres to be laid down, and possibly the limits are not yet reached.

Live Stock.

Pembrokeshire farming is mixed in the fullest sense of the word, as dairying, corn-growing, rearing of young cattle, horses, pigs, sheep, and all kinds of poultry find places on most farms.

Dairy-farming.—The dairy work consists chiefly of butter-making, the manufacture of cheese occupying a very secondary place, though on a few farms, and notably at Kilpaison, near Pembroke, very superior Cheddar cheese is made. Butter of a very high quality is made in all parts of the county, though I am inclined to think that the district to the north and east of Haverfordwest excels in this respect. The milk is usually allowed to stand twelve to twenty-four hours before the cream is removed, and for this purpose it is put generally in a shallow slate or metal oblong pan, the bottom of which inclines gently to the centre, where there is an outlet. In measurement, an average pan would be about 3½ feet long, by 2½ feet wide, by 4 inches deep at the rim, and 5 inches in the centre. To separate the milk, the wooden plug is removed from the central hole sufficiently to allow it to drain into a bucket underneath, leaving the cream behind. This is a fairly efficient apparatus. The cream, according to quantity and season, will be churned more or less frequently—on an average once a week; and for this operation a barrel-churn will, in nine out of ten instances, be used. There is every reason, judging from the prizes obtained by the celebrated churn-maker, Mr. Llewellin, of Haverfordwest, for Pembrokeshire to be proud of its barrel-churn, and the principal manufacturer of them. The butter will be casked during the summer months—except in the neighbourhood of a town, or under some other exceptional circumstance, where there is a sale for it in rolls—and sold to the butter-merchant for 11*d.* or 1*s.* per lb., if prices are good, though in 1885, 9*d.* was nearer the figure. There is no doubt

that much of this butter is worked up, and sold in the larger towns as fresh.

In the cooler months butter is brought to town in rolls or pats, and although these are called pounds, the weight varies from 16 to 18 ounces, according to the modification of an old custom adopted by each dairywoman. A very common practice formerly was to place an old-fashioned penny-piece in the scale with the pound-weight. The price of fresh butter varies considerably, both in locality and season: for instance, the price in Pembroke and Pembroke Dock is usually 1*d.* or 2*d.* more per lb. retail, than in Haverfordwest or Fishguard. The quantity of butter made per cow, when grass is plentiful, averages about 6 lbs. per week. Approximately there are some six million pounds, or over 2678 tons a year made in the county; probably this estimate is too low. The cheese as made generally throughout the county is, when compared to Cheddar, &c., of second-rate quality. It is, as a rule, deficient in fat, being made from skim-milk, and gets hard, instead of mellowing, if kept. It is, however, largely consumed in the country districts, and the retail price, being generally 4*d.* to 5*d.* per lb., favours its sale.

The skim-milk is also used for rearing calves, and for pigs until late in the summer; when the calves are all turned out, cheese is made.

Cattle.—The breed of cows preponderating is the Black, or some cross with it. Herefords, and more especially Shorthorns have been tried; but at the present time the balance of opinion seems to favour the Black, as being most suited to the requirements of the county. In 1874, the sound prescience of Mr. J. B. Bowen, of Llwyngwair, late M.P. for the county, in conjunction with the late Mr. Harvey, of Haverfordwest, originated the 'South Wales Black Cattle Herd Book.' Since that time very rapid improvement has taken place, until now the qualities and advantages of the breed, for this county, are recognised by the largest landowners. Earl Cawdor, at Stackpole Court, gave up one of the finest herds of Shorthorns to adopt the Black, and at the present time has probably the best herd of Black Cattle in the kingdom.

There are many in the county still who favour other breeds; but to turn natural selection topsy-turvy requires probably more knowledge than man at present possesses. Milking cows are generally out during the day all the year round, housing being only practised in very bad weather, and during the night in the winter months. They get the best of the grass, hay, and straw, with bran, crushed oats, mangolds, &c., and more recently

the various cakes. Usually the dairy is looked upon as the department of the farm which pays current expenses.

As to the number of cows kept, it is not, as a rule, large. Take a farm of 250 acres, with about one-third arable, and the cows will number about 20. Most of the calves will be reared, and in some instances some additional calves will be bought for rearing. The calves are fed on skim-milk, and encouraged to eat hay and straw; as soon as possible they are turned out on grass, and left to feed themselves till about Michaelmas, when they are housed every evening and shut in a shed all night, with straw to eat. During late winter and spring, when there is little grass, a few swedes are spread in the field for them in the day-time. In the second winter they usually get very little shelter, and, excepting those intended for the butcher, will be given straw, whole turnips, &c., in the field. Those for feeding are kept in a yard, and given plenty of straw and cut swedes. Generally those fed are sold in March and April, and all heifers not required will go to market as opportunities offer. Thus it can be seen that a farmer with twenty milking cows will have from 50 to 70 head of cattle on his farm at any particular time. The young cattle sold in the spring ought to "put the half year's rent right." Feeding is not extensively practised, more especially what is understood as stall feeding; though there can be little question that in the Black Cattle farmers have one of the best breeds for this purpose, as well as for fatting on grass; and to show the quality of their meat, I will quote some remarks on the "Block Test" in the 'Mark Lane Express,' * after a recent Smithfield Show. In referring to a Welsh ox the writer says: "The fore quarters of this animal were cut up, and for thickness of flesh, and total absence of wasteful fat, he surpassed by a long way any other animal seen in connection with the Show. The chuck ribs were of great thickness, with not more than about one inch of fat on the outside, the whole being profitable meat, fat interlaid with lean. The hind quarters were not cut up, but they were of the same useful character. Alive he appeared to be a ripe beast, full of flesh; as a dressed carcase he was not only the best butcher's beast, but far and away the best consumer's beast which came under our notice." Until recent years the Black Cattle were neglected; but there is probably a great future before the breed now, as it is already evident that, combined with their extreme hardiness, they possess the points of early maturity and aptitude to fatten; the only conditions necessary to obtain these being, that they should be supplied with plenty of wholesome food,

* January 12th, 1885, p. 34.

and a little care so as to ensure a steady and continuous growth from birth, instead of the old course of leaving them almost from birth to struggle into dwarfed maturity by neglect and semi-starvation.

The number of cattle of all ages taken out of the county every year is very great; large numbers go to Northamptonshire and neighbouring counties for feeding on their rich pastures. The exports under this head may safely be put at 25,000 head annually.

Pigs.—The pigs naturally come next, as being dependent on the dairy to a large extent. It is probable that, in reference to these animals, the Agricultural Returns convey no adequate idea of the enormous number reared in this county. The custom is to sell young pigs as soon as possible after they are about two months old, and as litters are born early in the year, the majority of which are sold in the spring fairs and taken out of the county, these are missed by the census taken the first week in June. Again, the second litters will come about July, and these are all missed as well.

The breed usually favoured is a cross between a long-bodied, flop-eared sow, and a short-faced, cock-eared boar. The pigs are allowed considerable freedom, and as a consequence good and healthy litters result. The young ones, being intended for market as suckers, get usually very fair treatment, being fed when a couple of weeks old on skim-milk and a little barley-meal. In the autumn, after the corn is up in mow or carried, all the pigs are turned on the stubble by day, and those not required afterwards are sent to the various autumn fairs in a capital fresh condition for fatting. Barley-meal is the staple feeding-stuff for pigs in this county, and certainly this material, combined with skim-milk, produces pork that is unsurpassed. Maize and rice-meal are used, but for quality barley has the preference. The sows usually rear their first litter when twelve months old, and are fattened generally after two years' breeding.

Horses.—Pembrokeshire horses have an excellent reputation, which, rumour says, is occasionally made use of by shrewd dealers, who come here and buy a few, then cross to Ireland to purchase more, and retail the lot as having come from this county. For farm-work, the quick-stepping, moderate-sized carter, standing 15 to 15½ hands, is preferred to the larger and heavier breeds. On a farm of the description before mentioned, the working horses would probably number five, of which two or three would be mares. This would mean two teams, and an odd horse used for various purposes, such as going to market, &c., or to fill the place of one of the others, or be added to a team on emergency. Farm-horses

are usually very well cared for, and in condition and appearance compare very favourably with similar animals in other counties. In summer they are turned out to grass, but from about Michaelmas are taken in and fed on chaffed hay or straw with gorse, and allowed a bushel or more of oats a week. With swedes and mangolds for a change, this feeding enables them to do a lot of work, and keep in good condition. Colts are reared and kept until two years old, when they either take the place of a mature horse that was sold at double the value of the two-year-old, or they are sold.

It depends, of course, on the fancy and circumstances of the farmer what other horses are kept, though the half-bred mare is very common, and the thoroughbred less so; both are used for breeding, and, thanks to the patriotism of some of the landlords, there are usually an excellent selection of stallions serving in the county in the season. Hunters and carriage-horses are reared in considerable numbers, and their value is attested by the eagerness with which they are sought, and the prices they realize. Ponies are plentiful, and a goodly number are reared in the higher and more mountainous parts of the county; but they are not so numerous as in some other parts of Wales. A very excellent sort of cob is bred by putting a mare-pony to a thoroughbred stallion; it will, when matured, stand 13½ to 14 hands, be well made, with plenty of bone, good action, rather an excess of spirits, and altogether it will be a most useful and enduring animal. In horse-flesh, the farmers of this county are generally credited with being abreast of the times.

Sheep.—Sheep have been much neglected in this county, being looked on more as the scavengers of the farm than as an animal which requires more than ordinary care, feeding, and attention. The many cold and wet summers of recent years, together with the heavy losses from liver-fluke, have convinced farmers that for sheep to succeed they require more consideration than they formerly obtained. The varieties in breeds and crosses are almost endless, and the numbers kept most variable. Some years ago, the Leicester, and crosses from it, were much favoured, and at the present time many of these are kept in the north of the county. Shropshires, and crosses from them, are more favoured in the south of the county at the present time. In the east and south-east, a breed known as the Llanboidy—from the locality in Caermarthenshire where they are reared—is much thought of. This breed appears to have originated from crossing the mountain-sheep with the Shropshire, and in appearance they are much like a Shropshire on short legs. Blackness of the face is sought, with a well-shaped body and shortness of leg. They seem to retain the excellent nursing

qualities of the mountain-sheep, together with their splendid-quality meat, at the same time being much bigger. Farmers like to buy ewes of this breed, and put a Shropshire or Oxford Down ram to them. The small mountain-sheep, whose qualities as nurses—for hardiness, and for the price which their meat realizes on the market—are scarcely equalled by any other breed, are not much kept except on the higher land, in consequence of their one fault, that they are of such a roving nature that no fence stops them.

Whatever sorts are kept, they are generally for breeding purposes, and the greater number of the lambs are sold in the autumn. In winter they are given whole swedes in the pasture-field, with a little hay if the weather is very bad. Hurdling is not much practised, though it has been found to answer well in the south of the county, the sheep only requiring to be turned out of the hurdles in exceptional weather.

It is found that lambs do better if born early in the year, as April and May being usually cold, with bare, easterly winds, and no grass growing, are much against them; therefore those who want to produce fat sucking lambs endeavour to stimulate early production. The following quotation of the management adopted by a gentleman who rents a farm on one of the red-sandstone ridges, will show that some pioneers in sheep-farming exist in the county. "After twenty-five years' experience of sheep, he has come to the conclusion that a cross of the Shropshire ewe with the Oxford Down ram meets the desiderata of early maturity, weight, and sufficient hardiness to stand the climate. His flock of 200 ewes, although they are usually nearly fat at the time, are turned on to corn-stubble preparatory to being divided into four lots, and one ram is apportioned to each lot of 50. These lots are kept separate for about six weeks, and are then united, to give the opportunity for any deficiencies to be made good. About a fortnight after, the rams are removed and the ewes turned into rough pasture; and should the weather be rough and stormy, hay is given once a day; roots, and more especially swedes, are avoided, as being detrimental to ewes in lamb. If the winter proves rough and cold, they get more hay, and in January are turned into keep specially reserved. As the time of lambing approaches, they are given about half a pound of oats and one or two mangolds apiece per day. Whilst lambing, they are shut in a well-strawed yard every night, and as the lambs drop, they, with their mothers, are put in hurdle-pens in a shed for a few hours, for the ewes to recover, and the lambs—more especially if twins—to know their mother and each other. The flock is then subdivided, to suit the opportunities of keep, &c. When a month old, the lambs are docked

and trimmed, and the best grass is supplemented by corn and mangolds. The ewes are shorn the first of June, and the lambs weaned early in July, at which time they are given oats or cotton-cake, as they withstand the autumn-growth of keep better, being less liable to scour. The lambs were formerly often shorn; but at the present price of wool, and as they probably do better in autumn without shearing, if it happens to be cold and damp, it is more profitable not to shear them. Those for sale are put on stubble, with as much hay as they will eat, and in addition receive cut swedes and one pound each of oats and cotton-cake per head daily. In March, a lot of about 200 head is usually sold, averaging in weight 15 lbs. to 16 lbs. per quarter."

This brief outline, of course, conveys but an imperfect idea of the care and attention bestowed by this gentleman on his sheep.

Poultry.—Poultry are generally an important item on a

TABLE COMPILED from the AGRICULTURAL RETURNS.

	1875.	1880.	1884.	1885.
Horses, including Ponies as returned by occupiers of land:—				
Used solely for Agricultural purposes ..	8,182	8,420	8,531	8,436
Unbroken, and Mares kept for Breeding	4,955	5,956	6,090	6,231
Total	13,137	14,376	14,621	14,667
Cattle:—				
Cows and Heifers in-milk, or in-calf ..	31,002	31,817	32,236	33,567
Other Cattle, two years old, and above	17,043	15,835	13,726	15,166
" " under two years old	32,694	37,486	40,908	41,517
Total	80,739	85,138	86,870	90,250
Sheep:—				
One-year old, and above	64,197	53,592	50,089	52,446
Under one-year old	53,818	45,438	48,007	50,209
Total	118,015	99,030	98,096	102,655
Pigs	23,559	21,537	24 376	24,318
Poultry:—				
Turkeys	..	..	4,400	4,011
Geese	..	..	20,721	20,347
Ducks	..	..	25,683	24,846
Fowls	..	..	85,625	84,734
Total	..	..	136,429	133,938

Pembrokshire farm; in largest numbers come fowls of various breeds and crosses, and the quantities of young reared in the county in the course of a year must be enormous, numbers being constantly sent to more populous parts for sale. Probably ducks come next in point of numbers, then geese, and in smaller numbers turkeys.

Rabbits.—The rabbits of this county—more especially of the coast line and some of the islands—have possessed a reputation for years, not only for the excellence of their flesh, but for the superior quality of their skins. Many thousands are sent annually to the large midland towns.

The table on p. 81 shows an increase in the number of horses; a large increase in cattle, especially in milking cows, and cattle under two years of age. The numbers of sheep are still considerably below those of 1875. Pigs have varied slightly in number from one period to another. The poultry returns have only been made for the last two years, and do not include those kept in towns, or by cottagers with less than a quarter of an acre of land.

Arable Land.

We come now to the arable part of Pembrokeshire-farming, and the prominence of the barn and threshing-machine at the homestead, and the lime-kiln in a suitable spot for the advent of limestone and anthracite coal, show at once the importance as well as the source of success of this department. For many years, no doubt, corn-growing was a very profitable occupation, but in recent times prices have fallen, seasons have been unfavourable, and labour has increased so much in value, that it is difficult to say whether it even pays any profit. Suffice it to say much land has already been laid down to grass, and this process still continues. Corn-growing has been chiefly carried on within a few miles of the coast-line, or in a part accessible by water. The reason for this has, no doubt, been that limestone is to be obtained in the south of the county only, and the strata being readily accessible to the many off-shoots of Milford Haven quarries have existed on its banks for generations.

Liming.—The greater portion of the anthracite coal used is also raised and shipped in the south. From these two circumstances it has resulted that a large number of small coasting vessels have been employed in the carrying of limestone and coal for agricultural purposes. During spring and summer for a long series of years all the little nooks on the coast where it was possible for a smack of from 20 to 50 or more tons burden to get in have been studded with heaps of limestone, to be carted to the adjacent kiln as required. Haverfordwest, almost in the

centre of the county, was most favourably situated, as limestone and coal could be brought by barge or small vessel up one of the tributary streams of Milford Haven. The considerable row of kilns on the river-bank in this town are eloquent witnesses of the brisk trade formerly done in lime. Since the advent of artificial manures many kilns have been neglected and fallen to decay, but I am inclined to think that lime-burning will increase again. The cost of lime ready for use varies with the locality, freight, &c., but may be taken to range from 4*s.* 6*d.* to 10*s.* per ton. In many parts it is considered that lime is too dear to use, unless the price of a bushel of corn, usually barley is quoted, pays for a cart-load.

The produce of some six to ten tons of limestone would be about the quantity applied per acre, and it is mostly slaked, mixed with sods or earth, and used as a compost, or it is carted to the stubble, slaked, spread, and ploughed in. The advantage of dry slaking and dry weather for working it are well understood.

Tillage and Implements of Cultivation.—Tillage in Pembrokeshire is not an arduous operation; two horses to single ploughs and three to double ones usually suffice. The implements used are not very numerous, though generally, in the hands that use them, very efficient. Until recent years, when railroads have rendered centralisation of industries possible, the greater part of these implements were of local manufacture, and even at the present time some of the most useful are home-made. The large number of excellent blacksmiths scattered over the county testify to the importance of this industry.

In ploughs a wonderful variety is seen in the present day; the old-fashioned county plough is without a wheel and is still largely used in many districts. It is usually considered to be superior to the wheel plough in broken land, where boulders of rock are met with, as the wheel passing over the rock lifts the share out of the soil too soon. In efficient hands—and these are still numerous—this implement frequently carries off the prize at ploughing matches. Such ploughs are manufactured in considerable number at a little place called Pontselly. In wheel ploughs perhaps Messrs. Howards' are most numerous, though other makers are well represented; the most recent introduction is the "Anglo-American chilled plough," and possibly these will be largely used, as they appear to suit the requirements of the county. The next implement is the harrow, and in this the county boasts of a speciality, which is locally known as the "chisel-tooth harrow." *

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* Well known in the Eastern Counties.—Ed. note.

The roller is the next implement, and the heavy iron ones have almost banished the old wooden rollers, except in the more secluded parts. The fluted roller or clod-crusher appears to find considerable favour. Cultivators, scarifiers, and other implements are used where circumstances permit, but the bulk of the tillage is done by those above mentioned. The ploughing is not usually more than from four to six inches deep, though probably most farmers on the limestone formation plough deeper if the rock allows it. In breaking up ley, or in ploughing land where couch is plentiful, it is usual now to fix a skim-coulter to the plough, as this cuts a thin layer of the roots which get buried much more completely, and in consequence have less chance of growing. Where shallow ploughing is practised and heavy harrows are afterwards used in an unsystematic way, couch and roots, that would have rotted if left buried, are dragged to the surface again, and the land is really kept in a foul state by ill-directed zeal.

Rotations.—The rotation of crops varies much; for instance, on the trap soils the usual course will be two or three years ley, oats, roots or rape, barley and seeds, or it is varied by taking a second white crop before the roots, thus: oats, barley, roots or rape, barley and seeds. In the south, again, after ley for, say, three years, there will be oats, roots, oats, barley and seeds: or three years ley, oats, roots, wheat, roots, barley and seeds; and this is varied by inserting a barley crop between the wheat and second root crop.

It is the custom generally to apply the bulk of the manure to the root-crop, and not manure again unless two white crops are taken in succession after the roots. The manures used are usually farmyard-dung and dissolved bones or superphosphate, the artificial manures being added to the dung to stimulate the early growth, and thus avoid the fly.

Oats.—As to the crops grown, oats occupy the most land, and it is the crop now usually sown when ley is broken up. The sorts grown are generally either the common black oat or Tartarians, and very frequently the two are mixed. The first produces more valuable straw for feeding purposes, otherwise perhaps the Tartarians, yielding most corn, would have superseded it. The quantity of seed sown will be from 4 to 5 bushels per acre if broadcast, and something less if drilled. This has been the most satisfactory crop during recent years, as it does well in all parts of the county, and the price of the grain has not depreciated in value so much as wheat and barley. The yield per acre varies much, though 40 to 60 bushels of grain, weighing 39 lbs. per bushel, is a fair average. The crop is cut with a scythe, carrying a light wooden framework called a "cradle,"

bound in sheaves, and made into small mows, each containing some 30 or more sheaves, and left for two or three weeks in the field to mature and dry.

Barley.—Barley, which in point of acreage now occupies the next place to oats, was formerly a much more important crop. Not only was this cereal used for bread and malting, as well as for feeding purposes at home, but large quantities were exported to Bristol and other markets. Very excellent quality grain is grown in the county, more especially on the trap-soils, though the cold and damp seasons which occurred about 1879 and 1880 very much affected the quality as well as the quantity.

This crop usually follows oats or roots, though on the trap-soils it is sometimes the first crop after ley, and it is often sown year after year on the same land; it is also the crop most favoured with which to sow grass-seeds. When this is the second white crop in succession, it is usual to apply about 6 cwt. of "dissolved bones," or rather more of "superphosphate" to the acre as manure. It is usual to drill in this crop, and about 3 bushels of seed are used. The cutting, binding, and mowing are much the same as for oats, and the average produce is from 35 to 45 bushels per acre, weighing 50 lbs. to 58 lbs. per bushel over the best land.

The usual time of sowing barley is from about the middle of April to the first of May, and of cutting, from about the middle to the end of August.

Wheat.—Wheat is a crop that does not appear to have ever been grown largely in this county; and in recent years, since the price has fallen so much, it is grown more for the sake of the straw than any other reason. It generally follows a root-crop, though formerly twelvemonths' bare fallow after breaking up ley was the correct course. No manure is applied, it being usual to manure the roots largely in anticipation of this crop. The custom of sowing wheat on ridges is now pretty well obsolete, and a considerable portion of that sown is spring-wheat. The varieties grown are many: Red Lammas was formerly a great favourite, and still finds friends; Red Chaff White, Golden Drop, Browick, and, in the more exposed parts, Red Hairy or Bearded, &c. The seed is drilled in at the rate of about 2 bushels to the acre, and the yield averages from 20 to 30 bushels, though on the better limestone-land it is usually nearer 40 bushels. This crop is generally cut with a scythe and cradle, and, after binding, is made—if the weather is fine—into similar mows to oats and barley. If it is bad weather, and the crop has been beaten down and damp, what are called stooks are made, and these stooks are very different to what are known as wheat-stooks in England. About six

sheaves are stood in a bunch on their butt-ends, and three or four more placed on top of these with their butts up, and bound round securely with straw-bands. These small mows stand a lot of wind.

It does not seem to be so much the custom now as in former years to make what are known as "knee-mows" in the field; these contained about 90 or 100 sheaves, and the person making them knelt on the top.

Harvesting.—Reaping-machines have been introduced into the county, but probably they will not supersede the scythe here, for, in the first place, no one will have much wheat to cut, and when these machines cut barley, it is more liable to sprout if the weather is bad at the time, in consequence of being delivered in a bundle instead of an even swath. Corn in this county requires some time for the straw and grain to mature and dry after being cut, and therefore there cannot be such despatch as is commonly seen in dryer districts. When carted to the haggard, moderate-sized stacks are adopted, and most frequently they are round; perhaps each stack may contain about 100 bushels of corn. These are small enough to obviate any heating, as well as being a convenient quantity to thrash out at once, and the round shape is more convenient where there are some ten or a dozen stacks in a haggard.

Thatching is generally done in a very neat manner; in fact, in some of the more exposed parts of the coast-line—about St. David's, for instance—the haggards at the end of October present one of the trimmest sights in the county. It is customary in thatching to use twisted straw-bands with single sharpened sticks, about 2 feet long, for spiggots. Where neatness excels, the straw-bands are placed diagonally across the dome-shaped top, about 8 inches apart, the longest extending some two-thirds around it, and as the bands cross, they form diamond spaces.

Formerly the threshing was all done by small machines—driven by horse- or water-power—attached to most farm-buildings; but at present "steam-threshers" are commonly hired throughout the county, when a considerable quantity is to be threshed at once.

Turnips, &c.—Of the root-crops grown, the turnip—in many varieties—occupies the first place; next, in extent of land occupied, comes the potato, and lastly, at present, the mangold-wurzel. Often all three species are in the same field, occupying the soil between two corn-crops. As before mentioned, it is customary to manure the roots heavily, so that the following crop will not require any more; about 20 tons of farmyard-manure, with 5 cwt. of dissolved bones or superphosphate

manures, will be a good average quantity per acre. The farm-yard-manure will be covered in the trench, and the artificial spread broadcast before the final ridging up. The ridges are about 27 inches apart for the turnips, swedes, and mangolds, and the seed is usually sown with an ordinary turnip-drill. When in rough leaf, they are hand-hoed and singled, the two operations being effected at the same time, after which one or two horse-hoeings usually complete the cultivation. Many varieties of roots are grown, though the white turnip, purple-top swede, and hybrids, with the long red, and yellow globe mangolds, seem the favourites. The yield averages some 15 to 20 tons of swedes, and 20 to 25 tons of mangolds. Many store their roots in clamps, or against a bank (fence), cover with straw and earth, and consume in due order of ripeness; but others, again, pull the swedes as required, only storing the mangolds. It is not usual to feed off a crop of turnips by hurdling sheep over them, although it is practised by a few; more often the turnips are given whole, scattered over the pasture daily, or cut for those cattle and sheep whose feeding requires to be hastened. Machines for cutting roots are very common. Some leave the tops to be ploughed in, while others give them, as well as the roots, to the cattle and sheep.

Potatoes are grown in moderate quantity; it is also customary for the surrounding cottagers to be allowed so many drills each in a field, on the condition that they find the necessary manure and labour of cultivation with the seed.

Manures for potatoes vary much, thus:—farmyard-manure, sea-weed, compost of culm-ashes, the cleanings of the pig's-cot, with muck and house refuse, and sometimes some artificial. The sorts planted vary much, as also does the yield, which in some years, in consequence of the "blight," is very small in sound tubers.

Rape is not much grown, as the harvest is too late to make a "catch crop" of it; if a piece of land is not ready in time to put in roots, this crop may be substituted, as it produces useful feed for sheep.

Grass Seeds.—The seeds for ley complete the rotation. As before mentioned, these are commonly sown with barley, though land is sometimes laid down after spring wheat or oats. It is very customary now to purchase a ready-made mixture of grass- and clover-seeds, though farmers would do much better with this crop if they were more careful what they sowed. Italian rye-grass usually occupies much too prominent a position in these mixtures. After the corn is in and rolled, the grass-seeds are sown, either by hand or a "broadcast drill," and covered with the chain-harrow.

TABLE COMPILED from the AGRICULTURAL RETURNS.

	1875.	1880.	1884.	1885.
Corn Crops:—				
Wheat	7,608	6,185	3,738	3,926
Barley or Bere	27,051	25,892	23,768	22,910
Oats	24,762	25,392	25,745	25,294
Rye	30	20	97	76
Beans	29	18	7	9
Peas	135	66	45	35
Total	59,615	57,573	53,400	52,250
Green Crops:—				
Potatoes	3,706	3,174	3,126	3,074
Turnips and Swedes..	7,776	7,114	8,376	8,155
Mangolds	1,280	1,331	1,284	1,343
Carrots	19	21	14	10
Cabbage, Kohl-Rabi, and Rape	477	433	650	631
Vetches	427	398	457	420
Total	13,685	12,471	13,907	13,633
Clover and Grasses under Rotation	35,825	28,789	29,096	31,214
Permanent Pastures	181,454	199,913	206,821	207,808
Bare Fallow	3,099	4,034	2,833	1,878
Total Acreage under Corn, Green-crops, Bare Fallow, and Grass (exclusive of Heath and Mountain Land)	293,678	302,780	306,057	306,783
Hay:—				
On Permanent Pastures	31,865	..	..	36,474
On Rotation Crops	17,060	..	..	15,769
Total	48,925	..	..	52,243

The above table shows a very considerable reduction in the acreage under corn crops in the last ten years, wheat and barley being the two cereals most affected. The green crops show a slight increase in turnips and mangolds. Permanent pastures have steadily increased in acreage, and show a difference in the ten years—1875 to 1885—of 26,354 acres. The quantity of land in bare fallow has considerably decreased. The acreage of crops reserved for hay shows in the total an increase of 3,318 acres in 1885 as compared with 1875, though the rotation crops reserved have decreased 1,291 acres.

The corn, with the young clover in it, requires careful drying, and the stubble is fed with sheep. The next season the crop is mown for hay, and sometimes twice in the season, though more often the second growth is fed off. In the second year the crop

is fed off, and the same in the third year, by which time it usually looks rather thin. Mr. Clare Sewell Read's suggestion in his report on South Wales * that, instead of bare fallow and barren ley, the soil should be given rest "under the shade of the turnip," was certainly not only poetical, but most excellent and practical; and probably the growth of more roots will do more good to the land and the farmer than almost anything else. Probably in no part of the county in the present day is ley-land to be seen "resting," for years in that whitey-brown, almost barren, state which he describes.

Pastures.—And now a word on the pastures, which comprise over two-thirds of the enclosed land of the county. These, of course, are the great sources of the hay and the feeding-ground for the cattle; and in many parts of the county there are excellent pastures, though, generally speaking, a very considerable portion of this land is much impoverished, and carries more weeds than good grasses. The more sparing use or entire relinquishment of lime in recent years has been much felt by the pastures; and whereas formerly Pembrokeshire was said to be the natural home of the *Trifolium repens*, it is now sometimes difficult to find it in a pasture. Of course, on the limestone and trap soils where lime abounds, this little white clover springs up vigorously; but in many parts the daisy, sorrel-dock, mosses, and various ferns are more predominant. The top-dressings applied to pastures are usually farmyard manure, or a compost of manure, earth, sand, and sea-weed, road scrapings, &c., though more recently bones have been used, either dissolved or as sold in what is known as "half-inch bones," &c. To keep down fern it is usual to mow it in the autumn, as the root is liable to rot before spring; this custom might be extended with considerable advantage.

Formerly it was customary to fog land, the object being to provide early keep in the spring; and to effect this, the field seems to have been locked up from about June. The increased growth of roots has probably superseded this custom, though the preserving of the aftermath is not uncommon.

The growth of grass in the spring is usually rather late, thus haymaking seldom begins before the middle or end of June. The mowing machine, wherever it can be used, has displaced the scythe for cutting the grass. The other machines used are the tedder or hay-maker, the horse-rake, and sometimes the collector. It is usual to give the grass ample time to dry in small cocks, before making into ricks. In carrying hay, the cart, with "tripples" on, is preferred to the waggon, and the hay

* 'Journal R.A.S.E.' 1849, vol. x. p. 157.

is not pitched off the cart on to the rick, but is upset by the side of the rick, and pitched from the ground. The custom looks rather slovenly to strange eyes, but the expedition with which a large rick of hay is carted and put up is surprising. Three carts, with one horse each, are usually the complement where the distance is not great, and these are kept constantly on the move. The elevator is a great help to Pembrokeshire farmers, and is very commonly seen at work.

The quantity of hay per acre is most variable, both in respect of locality and season. A great mistake is often committed by attempting to ensure a greater yield; it is to allow the grass to remain too long before cutting, the result being that the earlier grasses are spoilt, and the soil is exhausted unnecessarily.

There is one implement which is of great value on some pastures where moss prevails, and which is much used, viz., the grass-harrow.

Manures.—Having now in a general way indicated the usual customs with the most important crops, it will be well to mention that, where obtainable, many manures are used which are scarcely known in other parts of the country. The value of sea-weed for potatoes, or as a top-dressing for grass, is well known to those who live near any accessible bit of shore; sea-sand is often added to a compost heap when going on stiff land.

In the more mountainous parts paring and burning the surface is a common practice. Then, again, the usual fuel of the county being a mixture of anthracite coal and clay produces an ash which is an excellent manure. Where gorse has become old and full of rank grass, it is customary to set fire to it, when dry, in late autumn or early spring, with the result that the young growth following is eaten more readily by the stock. In general the farmyard-manure is made in open yards, in which perhaps the young cattle run, and into which the cleanings of the various sheds are brought. Usually there is a good deal of straw supplied to the cattle, a large proportion of which is trodden under foot. This yard is exposed to rain, and usually any drainings from it or the sheds are conducted to the adjoining meadow, where probably a single furrow has been turned by the plough, and this forms an irrigating channel. After the cattle and horses are all out, as opportunities offer, the manure is carted to a convenient spot, either in the field where it is to be used or to an adjacent bit of waste ground, and packed in a squarish flat-topped heap.

Labour.—The labour of the Pembrokeshire farm generally comprises boys and young men, who sleep on the premises, and receive in wages some 10*l.* to 15*l.* a year and their food; and

married men, who are found in food, cottage, and garden, and are paid some 6*s*. to 12*s*. or more shillings a week, with some extra remuneration for harvest-work, amounting to 30*s*. or 2*l*. Many farm labourers, with a cottage, have also the run for a cow allowed, or perhaps sufficient land for a couple of cows.* For hoeing turnips the labourers' wives get 1*s*. a day, and for harvest-work and hay-making 1*s*. a day and their food. If extra labourers are hired for harvest-work, they usually get 3*s*. 6*d*. a day. Hiring fairs are held about Michaelmas, when it is customary to agree with all servants for the ensuing year, and an agreement is sealed by the hirer giving the hired a shilling.

Balance Sheet.—I have intentionally avoided giving any form of balance-sheet, as the most superficial observer knows that agriculture at present is a hand-to-mouth business, and that it depends entirely on the aptitude and resource of the farmer whether he just makes a living or loses by his farm. In writing of the county it was stated that in consequence of the absence of trees it had a bare, inhospitable appearance; this appearance of the land does not agree at all with the character of those who occupy it, as a more kind-hearted, hospitable class than Pembrokeshire farmers does not exist. Probably with industry, thrift, and intelligence, together with great resource under difficulties, which are such common qualities amongst them, and the invaluable assistance rendered by their usually excellent helpmates, Pembrokeshire farmers will pull through the present crisis better than those in many other counties.

Three Divisions of the County.—In one respect the county is very peculiar, namely, that it is divided into at least three parts by differences of tradition and sympathy. To the north-east of the Precelly Mountains, the county assumes more the customs and ideas of Cardiganshire; in the centre and corresponding coast line is Welsh Pembrokeshire; and in the south is the English speaking district. In this English district, favoured as it is by the best land, and possibly also by its language, advanced agriculture is to be seen to a greater extent than in the other parts. It may safely be said that the Castlemartin district

* Pembrokeshire, according to the Agricultural Returns for 1886, Table X., occupies the singularly pre-eminent position of having the greatest extent of land allotted to labourers definitely for cow runs. No other single county division comes near it in number of acres; and considering the small area of this county when compared with some others, this is certainly an extraordinary fact Whereas in this county, with an area of about 400,000 acres, some 1105 acres are allotted to this purpose, Cardiganshire, which comes next, with a considerably greater area, has only 774 acres devoted to the same purpose. Lincolnshire, with an area of nearly 1,800,000 acres, has only 611 acres; and in the three divisions of Yorkshire combined, with an area of over 4,000,000 acres, there are only 1272 acres devoted to the same use.

is, under the fostering influence and example of Earl Cawdor, the garden of the county.

General Remarks.

To take a general survey of my subject, the first thing that occurs to one's mind is the evident fact, that rearing such a large number of young animals must be very exhausting to the soil; and, further, this exhaustion is not compensated by a corresponding amount of feeding, either by the fatting of cattle upon this soil, or by the application of manures in sufficient quantity. A milch cow obtains nourishment for her own body, as well as for all the constituents of her milk, from the food she eats; and this food being grass, it follows that the cow takes more from the soil than is returned to it in her dung and urine. The same thing occurs with the mare and ewe. Again, all growing animals require those constituents chiefly that build up bone and tissue; whereas the more mature animal that is fatting requires less of them. Therefore in the first the manure will contain less of these elements than in the second. The constituents required to form bone and tissue are chiefly lime, potash, phosphoric acid, and nitrogen; those required to form fat are carbon, hydrogen, and oxygen; both series are contained in milk. It has been stated that these constituents are all obtained by the animal from the grass eaten; the grass obtains all the first series from the soil, but the carbon almost entirely from the atmosphere, while the hydrogen and oxygen are derived from water. It follows from this that if the system of keeping milch cows and young stock be followed continuously, without an equally continuous returning to the soil of those constituents which these animals carry away, the land must become impoverished, that is to say, exhausted more or less of these constituents. Then as a consequence, the plants—sorts of grass which are richest in these constituents, and as a matter of course require them in the soil as food—become impoverished too. Inferior grasses take their place, and the pasture is not equal to feeding as many cattle as formerly, nor do the cows give the same quantity and quality of milk. That land in this county has been subjected to this sort of exhaustion there can be no question. I am well aware that very large quantities of manures are used in some parts of the county, and possibly more than in many other counties, but yet the land of Pembrokeshire wants more manure to bear the drain on its resources.

When Mr. Clare Sewell Read made his report, the only auxiliary manure was guano, but since then various so-called

"artificial" manures have been introduced into the county. Those that have taken the firmest hold are "superphosphate of lime" and "dissolved bones." It was soon understood by farmers that guano was what may be called an "all-round fertilizer," in a similar sense to good farm-yard manure, and not simply a stimulant. It would have been a great gain for farmers if guano of the quality of the earlier shipments had been found in sufficient quantity and remained the only artificial manure. At the present time—even supposing the artificial manures are what they are represented to be—the farmer is often in doubt as to which he had better use, and the price is such that he can very easily throw away the profit of his crop. The good results which follow in the pastures of this county from a dressing of dissolved or undissolved bones are well known; but the cost of this manure is considerable, and although it is in fashion at present, farmers might consider whether they could not supply similar constituents with equal results at less cost. Again, I may say that every farmer knows how well ewes and lambs do on land that has just been laid down with this manure. To prepare "dissolved bones," large quantities of sulphuric acid are used; and whether it is desirable to apply the quantity of this acid to the soil, as is done when using bone or mineral superphosphates, is a subject of which probably much will be heard in the near future. Perhaps some of those who in recent years have become acquainted with a peculiar turnip complaint, known as "fingers and toes," will have something to say on this point. If the farmer had always sufficient farm-yard manure of good quality to cover his pastures, there would be no occasion for artificial manures; but he has not sufficient in quantity, and the quality is usually very inferior, therefore to keep up fertility some auxiliary must be used. There can be little question that the land of this county was much benefited by the old custom of liming, and probably it will be well if those interested do not lose sight of the qualities of lime. Possibly our predecessors when the article was cheap, and the idea prevailed that it was a direct fertilizer, applied more than was necessary; but at the present time, when knowledge is so easily obtained, farmers should apply it in suitable quantity in combination with other manures.

It is pretty well understood now that the fertility of a soil depends on its mechanical condition as well as on its chemical composition. Thus a soil may be chemically rich, but unproductive from its unworkable, impermeable, or undrainable state. Probably no other constituent of the soil equals lime in its power to affect this mechanical condition beneficially; again, it aids in the decay of organic matter—a process which pro-

duces much fertility; it neutralises and so renders harmless numerous acids and other substances which are formed in the various processes of growth and decay in the soil; again, it forms compounds essential to plant growth, and it probably aids in the evolution of nitrogen, and also, as was pointed out by Dean Buckland a long time ago, of phosphoric acid from soils containing it. Very often one hears the remark, that superphosphates — bone or mineral — had a more beneficial effect when first used, than in recent years; possibly the fact that most of the land contained plenty of lime, had more to do with the early success than any variation in the quality of the superphosphates.

Sir J. B. Lawes has shown what different effects result from using different manures on pasture land, how with some the rank growing grasses will be stimulated so as to choke almost all others; and again, that other manures encourage the growth of the more valuable grasses and clovers. Every farmer in this county should study these results, as he would then understand how a soil constantly losing—as the soil of this county loses —its most valuable constituents, is unequal to the growth of the most valuable herbage.

The value of the growth in a pasture depends on its feeding qualities, therefore those grasses and clovers which contain the largest proportion of the constituents which go to form bone, muscle, and milk, are the most valuable. To expect these to thrive in soil already exhausted of these elements is of course useless. As to the course which the writer would suggest, it would depend a good deal on the nature of the soil. If the soil is deficient in lime and the clovers want stimulating, or the daisy, mosses, and such like are abundant, an occasional liming in moderate quantity would be advisable. Of other manures, it is assumed that the farmer requires all the dung for roots, otherwise this is doubtless the best; then dissolved bones would cost about 6*l.* 10*s.* per ton, which might be considered too dear. Therefore we look in another direction for the phosphoric acid, nitrogen, and saline constituents—chiefly potash—which are required. Possibly a mixture of 15 cwt. mineral superphosphate, costing 3*l.*, with 1 cwt. sulphate of ammonia, costing 12*s.*, and 4 cwt. of kainit, costing 13*s.*, or a total cost of 4*l.* 5*s.*, would be a ton of manure suitable. These prices are the extreme local value.

Management and Feeding of Cattle.—The next point that occurs to one is the management and sort of food supplied to the young and mature cattle and sheep. In considering this we have excellent guides in the customs of those who excel in rearing the best cattle and sheep in the county.

In the rearing of calves it is too much the practice to keep more than there is skim-milk for, and to turn them out too soon, the result being a struggle for existence; not an easy walk into maturity, which is the course that produces the most profitable animal. If those who wish to rear a large number in proportion to the milk supply would give the calves more additional food, like linseed-tea and the cake made from this seed, the result would be better. Then, again, they should not be turned out until there is food for them, and the weather suitable. One gentleman of considerable experience, who rears some of the best cattle in the county, tells me that his early calves—some of which are born before Christmas—seldom go out before June, and he is careful not to turn out the late ones during the very hot weather. With respect to the older cattle, there is ample room for an increased use of feeding-stuffs, like linseed- and cotton-seed cakes. In all, this would mean better condition, and an increased value of manure; and in the milch cow and ewe, an increase in the quantity as well as an improvement in the quality of the milk.

The same remarks will apply to the sheep, as they would be much benefitted by the use of more of these cakes. It is generally thought that because the farmer has his oats and barley at hand, it is more profitable for him to feed his cattle and sheep on these than to sell them and purchase the cakes mentioned. A few figures from Sir J. B. Lawes may cause a reconsideration of this custom, therefore I venture to mention it and cite an example.

If we take oats as worth 1*s.* 6*d.* a bushel, a ton would come to about 4*l.* 6*s.*; barley at 2*s.* 6*d.* per bushel would come to, say 5*l.* per ton; decorticated cotton-seed cake would cost, say 8*l.* at the extreme local price. The value of the cake as a food would be about double that of either the oats or barley, consequently we gain a profitable balance in value over the barley at once. But the great difference is seen when the increase in the value of the manure of the animals is considered; the estimated value of manure from the consumption of a ton of the cake being 5*l.* 13*s.*; from a ton of oats, 1*l.* 10*s.*; and from a ton of barley, 1*l.* 6*s.* This supplies a considerable amount of food to reflect on, and I am inclined to think that those who have seen the results on the pastures of this county, where decorticated cotton-seed cake has been much used, will acknowledge its superiority. Oats and barley have their place no doubt, and my object is not to exclude them, but to suggest the advisability of substituting cotton-cake where suitable; also to point out that this can be profitably done even at the present low prices.

Rotations.—The next point that strikes me relates to the present systems of rotation, and their management. It was previously remarked that land was not now left in ley for as many years as was formerly the custom ; and, as is well known, the shorter time a field is in grass before being again ploughed, so much more nitrogen does it require in the manures applied for the arable crops. This necessitates a few words on what really is meant by "resting" land in the manner practised.

The principal effect of pasture plants on the soil is to increase its organic constituents; this results from the decay of the roots of these plants. It has been calculated that the roots are equal in weight to about one-third of the crop, and as roots mature and decay—as the part of the plant above ground does,— it is easily understood that this decay of roots means a great deal. Again, the constituents of the roots vary, like those of the plant, in different species, consequently the decay of the roots of some species produces more effect than others. Every farmer knows what a fertilizing effect the decay of clover-roots has. Another effect of pasture is, that as the roots of the plant penetrate deeply they assist in the permeation of the soil by rain and air ; these not only act beneficially on the soil, but also carry down fertilizing elements, which are absorbed and stored. Again, as the soil is not disturbed the earth-worms increase, and the most superficial observer knows how continuously they deposit the best of mould on the surface. Thus it is desirable, in order to obtain the greatest benefit from two or three years' ley, that the valuable grasses shall be sown. I consider that the result usually obtained in this county is one heavy crop of rye-grass and some rank-growing clover; the second year an inferior crop; and the third year little rye-grass, or the rank clover, but plenty of bare patches, and the soil exhausted to an unprofitable extent.

Why rye-grass should be in such favour is, I suppose, because it makes a good show, and throws a heavy crop; but if its feeding qualities, and the effect of its growth on the soil be compared with some other grasses, probably opinion will alter respecting it. I would suggest growing a lighter crop of better quality, and to obtain this I would exclude rye-grass—except the sort known as perennial,—substituting cocksfoot and timothy grasses in increased quantities.

Deeper ploughing, where possible, would probably help the grass seeds ; though most of the land in the county, if laid down in good condition, produces excellent natural pasture.

There is little to be said of the other crops of the rotation,

except that the soil could in many instances be ploughed deeper with advantage. If corn likes a shallow ploughing immediately before being sown, it does not follow that a shallow soil is also the best. The first would simply mean that it was best for the soil to have settled sufficiently for the roots to get a firm hold; but the second—if correct—would mean that corn does not root deeply, which—as is well known—is wrong. Corn will root to a great depth if the soil is suitable, as will also clovers and many grasses.

The farmer could very advantageously plough to an increased depth in the winter before the root crop was grown. There is very little soil in the county that would not benefit by being ploughed deeper, and as some of the soils are very apt to "pan," there is all the more reason for an occasional disturbance. It is very generally understood that phosphoric acid is required by, and that it stimulates, a root crop; also, that nitrogenous manures stimulate a corn crop; but it is not so well known that potash, though it does not stimulate, is equally important to all crops. The knowledge required is usually how to make a suitable mixture of artificial manures for the crop in hand. A source from which considerable supplies of potash could often be obtained is almost entirely neglected; this is the trimmings of banks, hedges, &c. These are sometimes burnt, but as a heavy shower of rain on the ashes leaves very little undissolved, the idea is that the ashes contain little. Were these odds and ends collected and burnt, the ashes carefully collected and used as if bought at a high price, the results would be convincing.

Change of seed is much practised, and its advantages are recognised, but the necessity of obtaining good and clean seed—free from weeds—is not sufficiently attended to. I fear that I have been rather discursive in reviewing my subject, and therefore will now proceed to the final section.

Improvements required.—Those who are fond of styling themselves reformers would often be more correctly named revolutionists, their idea of reform being to replace the existing by some other system. Whether this root and branch style of reform is suited to anything else, it is unnecessary to inquire; it is sufficient for my purpose to know that it is not suited to agriculture. Natural conditions have probably more to do with the origin of the varying systems and customs of different localities than anything else; and the farmer shows his aptitude for his business, when he modifies his ideas to suit these conditions. I have therefore no patent "bag and baggage" policy to suggest, but simply one or two little things that can be grafted on the present system without much trouble.

In the *first* place, I think that "elementary agriculture" should be taught in all the rural schools of the county.

The *second* is that landlords should continue the course—which the majority of them have commenced—of providing their tenants with sufficient and suitable buildings, so that they may manage their farms and cattle in the most advantageous manner.

Thirdly, I would suggest that landlords assist their tenants in the purchase of artificial manures; not by bearing any of the cost, but by using their influence, either individually or in combination, to secure for their tenants manures of the value paid for them. This could be easily managed, and is, I believe, already practised by one landlord, if not by more.

The *fourth* suggestion is, that landlords should not only have their estates carefully mapped, and the varying nature of the soils—in separate fields, or even in different parts of the same field—specified for their own information, but should supply each of their tenants with this information so far as it affected his holding.

The *fifth* suggestion would be almost certain to be carried out if the last one was adopted; it is, that land requiring it shall be drained and put into a condition suitable for obtaining the most profit from it. There can be little question that drainage, and, in the case of arable land, deep ploughing, would produce this condition on most of the formations of the county; but probably on the coal-formation and millstone-grit it would be advisable, after drainage had done its work, to subsoil in preference to deep ploughing. These soils in places contain constituents injurious to plant-life, therefore it would be preferable for these to be gradually washed downwards than to be brought to the surface. The suggestion which occupies the *sixth* place has reference to the storage of farmyard-manure.

We have seen that farmers in this county have not sufficient farmyard-manure for their requirements, also that this manure is usually of inferior quality, from the sort of animals forming it, and the nature of the food supplied to them. Again, this manure is stored in an open yard, or in a heap exposed to rain.

It is generally understood throughout the country that it is advisable to protect the manure-heap from rain; and if this is the case in counties where the rainfall does not exceed 25 inches in the year—such as the eastern counties of England,— how much the more necessary must it be in this county, where the rainfall ranges from 40 to 50 inches in the year. Supposing we have a heap of manure about 8 yards wide by 12 yards long, or say 100 square yards in area of surface; then, as 1 inch of rainfall over 1 square yard means from 4½ to

$4\frac{3}{4}$ gallons of water, 1 inch of rainfall on this manure-heap would mean over 450 gallons. Supposing again that this heap is only exposed to 20 inches of rain, the total quantity falling on it would be over 9000 gallons.

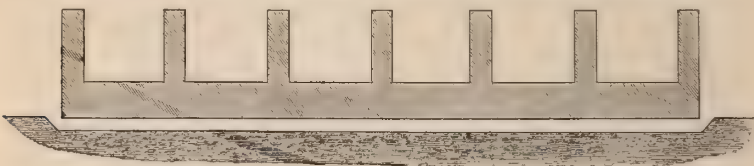
It is well known that the most valuable constituents of farmyard-manure are washed out by rain, therefore there can be no wonder if the farmyard-manure so made is of little value. Then again, the urea, hippuric acid, &c., contained in the urine of animals are the sources from which is mainly derived the necessary nitrogen; and this is usually allowed to run wherever gravitation will take it. With the aid sometimes of a furrow ploughed across the adjoining meadow, this liquid portion and the rain from the sheds and yard irrigate a small portion of land. Apart from this, it is entirely neglected by the majority of farmers. There are probably very few farmers but at sometime or other have noticed that the last few loads of manure which—in consequence of the heap being used up—had to be fetched in a raw wet state from the sheds to fill the last turnip drills, produced more effect on the crop than the rest. This result would probably arise, partly from the more beneficial effect of manure which decays in the soil, but also from the quantity of nitrogenous matter in this raw manure wet with urine.

It is not always possible for the farmer to put the manure in the soil to decay, otherwise no better plan could be adopted. My endeavour will be now to show how easily the landlords of this county can enable their tenants to store the whole of the farmyard-manure protected from rain, with the result that what they then carted out would be very much more valuable than what they now use as manure. Nearly all farm-buildings in this county are built, more or less rectangularly; that is to say, the buildings enclose a yard which is more or less square or oblong.

This yard is usually now the storage place for the manure, and under my suggestion will remain so, with the slight difference that a pit is made in the centre of it—of a size suitable to the requirements of the farm—and covered with a roof. When it is known how many hundred loads the farmer will want to store, a space will be measured off, of an oblong shape and suitable size in the centre of this yard; next, the middle part of this space will be excavated to a depth of something over 3 feet; and the ends, over a sufficient distance, will be formed on an incline to this middle part. Side walls will be built about 6 feet high, which would bring them some 3 feet above the level of the yard. The floor of this pit must be covered with concrete to prevent any percolation of the contents; there should be a

suitable roof put over it and a gutter pitched all round, so as to prevent the pit being flooded by the drainage of the yard. All the manure must be brought direct from the byres into it; the urine and liquid part will be collected in a small tank at the end of the gutter of the byre, and this will also be conveyed as occasion required—that is, when the small tank was full—to the pit and thrown over the more solid parts. When the time comes for carting this manure out, the sloping ends of the pit will enable the carts to be backed right into it, for convenience of loading. After the manure has been carted away, the bottom of this pit will be a convenient place to put the culm and other ashes from the house, and these will provide an absorbent layer under the manure which can be used with it.

Figs. 2 and 3.—*Longitudinal and Transverse Sections of Manure Pit.*



The incline at each end extends one-third of the length of the pit.

60 feet long by 30 feet wide, and capable of holding some 400 loads of manure.

The accompanying sketches (Figs. 2 and 3) will illustrate the form of the covered pit. Of course iron pillars can be substituted for the stone or brick ones indicated.

This shed would only occupy the centre of the yard and would not interfere with the free circulation of air to the sheds around. In this respect it would be preferable to covering in the whole yard. A practical builder has informed me that a shed of the size indicated in the sketch—capable of storing some 400 loads—could be erected anywhere for 90*l.* The tank for collecting the urine and liquid part would be placed in a corner of the byre at the lower end of the gutter and would be of the simplest character. A hole dug and bricked, bottom and sides, leaving a capacity of one cubic yard would do for a large

shed, as the oftener it was emptied over the solid parts of the manure in the pit the better.

I consider that this would be a way of making and preserving manure suitable to the requirements of this county; and I would like to see such manure sheds, of a size suitable, erected on every farm in the county.

Where expense is no object, I am aware that whole yards have been covered over, and the solid part of the manure stored here; but the liquid part has been conveyed to a tank by itself and used by means of a liquid-manure cart over grass land. This may do where there are facilities for it, though I think there can be no question that when the solid and liquid parts are combined, the manure must be better than either separately. My objection to covering the whole yard, beyond the additional expense, has been stated.

The *seventh* suggestion has rather a local application, though possibly to a less extent it would be suitable in other parts of the county. In the higher lands, that is, the mountainous part of the county, are many considerable tracts which now produce little beyond heather, gorse, brambles, and rank grass. Over these tracts roam a few mountain sheep, ponies, or, in the summer, young cattle. Probably if the larch was planted it would do well over most of this land, and not only be a paying plantation, but an improver of the soil as well.

Having now endeavoured to meet the requirements of the Royal Agricultural Society by describing the agriculture of Pembrokeshire as it appears to me, and having—whilst writing it—received many valuable suggestions from numerous friends, I beg to acknowledge my indebtedness, and express my thankfulness to these gentlemen.

At the same time, my idea has been to make the essay as original as possible, and I am only too conscious of the consequent imperfections of my work.

I trust, however, that, if many things have not been inserted that should have found a place, there is nothing in it which had better not have been written.

IV.—*Report upon the Spring Show of Thoroughbred Stallions at Newcastle-upon-Tyne.* By WILLIAM BLEW, M.A., of Tiverton, Tarporley.

"I SHOULD like," wrote Jeremy Bentham, "to live the remaining years of my life a year at a time, at the end of the next six or eight centuries, to see the effects which my writings

will, by that time, have had on the world." Possibly a similar sentiment may have entered the minds of the gentlemen to whom belongs the credit of proposing and carrying out in all its details, and to its consummation, the show of thoroughbred sires held at Newcastle-upon-Tyne on the 25th of January last. Whatever others may feel concerning the matter, they at least must, so far sympathize with Mr. Bentham as to be curious as to the effect of their undertaking upon horse-breeding. It may perhaps be permitted to the writer of an official, yet undictated report to remark that the occasion was a memorable one in the history of horse-breeding. The various legislative enactments which, in earlier times, were passed to guard against a failure of supply, or a falling off in the quality of our native horses rather savour of "that advice which costeth nothing." It was reserved for the Royal Agricultural Society of England to make the most liberal attempt on record to encourage the breeding, by farmers and others, of hunters and other half-bred horses. There is not far to seek for the *raison d'être* of the recent show. Not for the first time has the cry been raised, and it is to be feared with only too much truth, that we in England are very badly off for horses of a certain class. That many of our carriage-horses come from abroad we know. Mr. Augustus George Church, while being examined before Lord Rosebery's Committee of 1873, stated that most of the horses working in the London General Omnibus Company's vehicles were foreigners: "it is not an affair of price, but of absolute scarcity," he said. Dealers have affirmed that they cannot procure a sufficient supply of high-class weight-carrying hunters; while, and most important of all, Colonel Ravenhill, in a lecture delivered at the Royal United Service Institution, drew a terrible picture of our shortcomings in the matter of army horses. Whether the Colonel's figures were absolutely correct or not is immaterial; but that he was right in the main became obvious, when the Government sent him and his *confrères* to Canada to report upon the resources of the Dominion. This course drew forth, in some quarters, the remark that, with the exception of the Committee of 1873, the Government had never yet spent the price of the expedition in furthering horse-breeding at home, either by inquiry into home resources, or by trying to buy any of the horses that farmers may happen to breed. It is only quite recently that the Government stated that they were not prepared to inquire into the horse-supply question.

It was stated just now that the cry of a scarcity of horses was not a new one. Nor is it. It would appear to have formed the ground-work of early Acts of Parliament, and was raised by De Blunderville in Queen Elizabeth's time; by the Duke of New-

castle in the reign of Charles II.; and had not subsided, according to De Berenger, "when George the Third was King." Then, in addition to the circumstances aforesaid, to which the recent show owes its origin, persons, whose opinion is entitled to the greatest respect, say that breeding hunters, and what Mr. Lupton calls "general utility horses," does not pay, and farmers have written to the papers to the same effect. That farmers should find in the breeding of horses (other than heavy draught-horses) a remunerative undertaking is desirable for many reasons; but especially for two. It would be a stand-by in these times of depression, and it would give to this country the army horses which she so sorely requires, and which she may one day require still more. But the statement that breeding does not pay is, like the cry of scarcity, a thing of ancient date. In one of his letters to the 'Sporting Magazine,' "Nimrod" committed himself to the assertion that, "under proper management, a good three-parts bred mare may be a little fortune to a farmer." In the number of the above publication for March, 1825, "A Fox-hunting Farmer" joined issue with Nimrod, and concluded by setting out his balance-sheet of the "Sale of the produce of a remarkably fine hunting mare." From this document, which appears to be a very fair one, it seems that the "remarkably fine hunting mare" bred ten foals. One died early, and a second was lost after reaching the age of three years; but the remaining eight, after deducting the expense of keeping the defunct three-year-old, brought 581*l.*, or an average of 64*l.* 11*s.* each for the nine. The farmer calculated that he lost 35*l.* 9*s.* over each of his nine youngsters!

In the face of all this it may be asked, "When did breeding ever pay?" An attempt has heretofore been made to show that the breeder was ruined when railways drove coaches off the road. This is clearly wrong. In the days of fast coaches the average price for leaders was only about 25*l.* at the outside, and about 5*l.* or 7*l.* more bought the wheelers. Not one coach-horse in 500 came direct from the breeder's hands; he only found himself before or behind the bars when accident, blemish, or temper had reduced his market-value to the contractor's price. On the other hand, there is now a greater demand for horses than ever. The London and provincial omnibuses and cabs have taken the place of the coach; more private carriages are kept, more men hunt than formerly, and our army is short of horses. If, therefore, breeding be the commercial failure it is said to be, the reason has yet to be given. Assuming proper material to work upon, and the exercise of a little care, if breeding does not pay the farmer, it is difficult to see to what other class of persons it can be remunerative. The farmer growing his own forage can keep his horses more cheaply than he who has

to purchase his hay and corn; unless he breeds on a large scale, he need be at no extra cost for labour, while his farm-buildings will furnish all needful accommodation. When a man has to buy his provender, hire the necessary land and buildings, and engage servants to look after mares and foals, breeding may then be carried on as a hobby, but certainly at a loss. Hence the necessity, if it is desired to increase the number of horses bred (of improving the stamp something will be said presently), of trying to induce every farmer to breed one or two colts annually. He can breed more cheaply than anybody else, so long as his breeding is strictly subservient to his farming. If he once reverses this order, he is nearly sure to come speedily to grief, for a distinction must be drawn between horse-breeding as an independent calling and horse-breeding as an incidental branch of farming. As supplementary to farming, breeding may or may not pay; as an independent venture, it would in all probability result in failure.

Now everything must have a beginning; the boldest experiment ever yet taken in hand by man must have for its object the accomplishment of some definite purpose, which purpose will be less comprehensive than the whole range to be eventually covered when the first step shall have been successfully taken. In the endeavour to encourage the breeding of hunters and other half-bred horses, the first step must be to place within the reach of breeders a good sire at a reasonable fee. It is useless to point out to a farmer the whereabouts of a fitting sire whose services can only be secured at a fee of from 10 guineas upwards, with all the attendant expense of sending the mare and paying for her keep. It is true that when spread over three or four years there is not much difference in the cost of producing a colt, whether the fee for the sire be 50*s.* or 10*l.*: but inasmuch as the farmer has to pay the fee down at once, the saving of 7*l.* 10*s.* is very appreciable. To provide sound sires at an almost nominal fee was, I take it, the first object of the Royal Agricultural Society in organising the Newcastle show. The complaint of the scarcity of horses possessing both power and "quality" had attracted considerable attention; the press commented upon it, and people, not unnaturally, looked to the Society to take some steps in the matter. It is the mission of the Society to encourage live-stock of all kind, horses included. The project of holding the show was mooted in 1885, and a Committee, with the Duke of Richmond and Gordon as Chairman, was forthwith appointed to draw up a scheme. The Committee met five times, and at the monthly Council held on Wednesday, the 2nd of June, 1886, the Earl of Coventry presented their report, in which the Committee recommended

the holding of the show under the rules and conditions which governed it at Newcastle in January. The debate, which followed the presentation of the report, showed that there was not complete unanimity as to details, for a minority advocated limiting the premiums to 50*l.* each. All, however, were agreed as to the necessity of doing something in the endeavour to give an impetus to horse-breeding, and the endeavour at last took the form recommended by the Committee, viz., the offering of five equal premiums of 200*l.* each, and a special gold medal for thoroughbred stallions (3 years old and upwards) suitable for getting hunters and other half-bred horses, subject to the condition and restriction that each stallion winning a premium should serve not less than 50 half-bred mares, if required, during the season of 1887, and should stand or travel (at the owner's option) in such parts of Northumberland, Durham, Cumberland, and Westmoreland, as should be specified, at a fee not exceeding 50*s.* for each mare, except to members of the Society, to whom the fee would be 2*l.*

A better division of England, (the ordinary division of the Society for this year's Country Meeting) or a better place than Newcastle, could not have been fixed upon for the inauguration of the experiment. Wherever bricks and mortar, or the exigencies of the great industries of the North do not render hunting impossible, there is the fox pursued with a vigour which is exceeded in no portion of England. It would have been difficult, too, to have selected any other quarter where such an enormous crowd could have been attracted as filled that portion of the Exhibition buildings devoted to the purpose of the show. An audience can always be secured when a competition for jumping prizes is the inducement to come ; but it is only in an essentially sporting district that men will come in thousands to see fifty thoroughbreds walked round and examined. This, after all, is the relic, or the revival, of the old enthusiasm for horse-breeding which once had fast hold on the men of the North. The counties in which the five winners are to stand have one and all a horse-breeding history to tell. Northumbrians assert that, until within the last 60 years, the county of Northumberland not only bred all the hunters required for home use, but sold large numbers to the dealers who were wont to repair with unfailing regularity to the fair on Cow Hill, or to the breeders' homes, in the certain hope of finding something worth bringing away. Among the hunter-sires that made a name for themselves in Northumberland may be mentioned "McOrville," by "Orville," a horse that was almost deemed worthy, by Northumbrian breeders, of being shod with gold, and it is due to this horse that so many grey hairs are observed even to

this day in horses in this district. Nor was their respect for him misplaced, as he exercised great influence on the breeding of hunters in the county. Next, perhaps, in popular estimation may be ranked "Perion," by "Whisker," out of "Darioletta," the dam of "The Flying Dutchman," "Van Tromp," and "Barbelle," a celebrated brood mare. "Perion" was brought into the county through the foresight of Dr. Headlam, of Newcastle, whose fame in stud-book knowledge was as great as that of Dr. Bellyse, of Audlem, Shropshire, in all matters connected with cocking. "Motley," by "Touchstone," out of a Lanercost mare, is another whose name is not yet forgotten, and the same may be said of "Pine Apple," the sire of a race of rushers and pullers, yet fine jumpers, and of hardy constitution. In Durham, "Sir Peter" was a great success, and so was Sir H. Vane Tempest's "Hambletonian," whose services the tenantry were welcome to at next to nothing. "Dr. Syntax" has been often talked about as a great hunting sire, though as a matter of fact he was not in great repute in Durham; his stock were apt to be leggy, narrow, and only light-weight hunters at the best. In this respect he differed greatly from the famous "McOrville," who travelled Durham as well as Northumberland, and who invariably got short-legged, weight-carrying horses, no matter what sort of mare he was put to. This, at least, is the reputation "McOrville" bore in the North, though, perhaps the praise must be subject to a trifling discount, as experience has shown that the selection of the mare has a great deal to do with the excellence of the foal. On this question, however, something remains to be said presently. A good deal has recently been heard of the qualifications of Arabs as hunters, and some there are who would have history repeat itself by crossing our half-bred mares with Eastern sires. This experiment was tried in the North about 35 years ago, I believe. A Mr. Attwood had an Arab stallion or two. The young stock are said to have been hard, wiry animals, that would go well when apparently over-weighted; but they lacked pace, and were deficient in jumping capabilities. "Paulus," by "Emilius," was another travelling North-country sire, and a favourite one for weight-carrying hunters. The aim of breeders at that time was to put mares by "McOrville" to "Paulus," a plan that is said never to have failed to produce a valuable animal. If mention be made of "British Yeoman," "Royal Ravenhill," "The Judge," "Gamester," "Laughing Stock," and "Revolution," an unfashionably bred horse, being by "Oiseau," the chief sires, which in older days made their mark in the North, will have been noticed. To repeat,

therefore, what has been said previously, Newcastle-upon-Tyne was by no means an inappropriate place at which first to try the experiment upon which the Royal Agricultural Society had determined.

In another respect, also, the *locus in quo* was a happy one. In consequence of the holding of the forthcoming Mining and Industrial Exhibition at Newcastle, a spacious range of buildings was ready to hand, which gave the advantages of good roomy stabling in which the horses could be easily seen by visitors; a commodious arena in which the horses were paraded and judged; an isolated and spacious bay in which the veterinary officials conducted their examination; and lastly, though by no means least, ample room was found for the large number of persons who came to see the show. Jubilee buildings will not be erected every year, and on future occasions the Society may not be so fortunate in securing so commodious a covered-in place for the exhibition. The task of finding proper accommodation in Newcastle for the horses was entrusted to Mr. Clement Stephenson, V.S. There were a few arrivals on Saturday, but most of the horses reached Newcastle on Monday, the 24th of January.

Tuesday morning saw the show in complete working order. 45 horses were in the catalogue, and 7 of them, viz. "Beauclerc," "Glendale," "Pedometer," "Peppermint," "Pursebearer," "Theologian," and "Uncas," were for exhibition only, and not for competition. Scarcely were the doors opened ere the half-crowns began to come in, and in a short time a goodly number of critics were in front of the boxes, anticipating, as best they could, the decision of the Judges, who, by the way, were the Earl of Coventry, Mr. W. Dunne, and Mr. E. Paddison. The horses were brought into the ring in batches of ten; and perhaps the most convenient plan will be to take them in the order in which their names appeared in the catalogue. No. 1, Mr. Dunhill's "Alchemist," by "Rosicrucian," out of "Gold Dust," by "Newminster," and bred at Middle Park, was withdrawn. Judged by the highest standard, "Beauregard" (10 years), by "Macgregor," out of "Marquise de Caux," by "Thormanby," and owned by Mr. John Jackson, of Great Ayton, Northallerton, scarcely possessed all the points desirable in a hunter. His limbs were not of the very best, he appeared somewhat light in his middle piece and showed a somewhat heavy neck. The American-bred "Blue Grass," by "Pat Molloy," out of "Amy Farley," is, in many respects, a nice horse, albeit scarcely a hunter. His colour, a bright golden chestnut, is not an unpopular one; it would be hypercritical to wish for better shoulders; his back and loins, if not indicating abnormal power,

are at least up to the average; while nothing in his batch moved with greater freedom. When he stood still, however, it struck the spectator that—on the assumption of like begetting like—his hind legs were rather farther away from him than one desires to see in a hunter sire. As a two-year-old, "Blue Grass" was unquestionably a failure on the Turf; he ran three times unsuccessfully. In the following season three races at a mile fell to him; he ran once as a four-year-old; and as a five-year-old is best remembered for his victory in the Northumberland Plate, when carrying 7 stone 13 lbs. In the same year (1885) he won the Cumberland Plate over a mile and three-quarters, and a two-mile race in the shape of the Bentinck Memorial Plate at Goodwood. As things go, therefore, it may be set down to the credit of "Blue Grass" that he has won what must now be considered long-distance races, if that be a recommendation in a hunter-stallion.

Mr. Thomas Holmes's "Chapel Royal" is by "Hermit," out of "Sister to Adelaide," and therefore brother to "St. Mary," who cost 3900 guineas as a yearling. "Chapel Royal," on the other hand, was bought by his present owner for 300 guineas. He is rather too long in the back and short in the quarters to fill the eye, and it was not a matter of surprise that he was omitted from the number of those deemed worthy of a second inspection. I believe that only a short time has elapsed since little "Dick Swiveller" left the training stable, a circumstance which will account for his not carrying a great deal of flesh. On the Turf he did not leave his mark, except when a two-year-old. He then won three races, and was esteemed smart. As a three-year-old he ran once, unplaced, in a 5-furlong race in very moderate company; the 'Racing Calendar' knows him not in the next year; while as a five-year-old, his solitary performance was in a mile race, in which he was nowhere. What his success as a hunting sire may be remains to be proved. He is by "Joskin," out of "Little Nell," by "Blair Athol." In size he belongs to the small division, but is very fairly off for bone, is compactly put together, and has a good back. No exception can be taken to his shoulders or quarters; but he has a weak point in his rather long pasterns. Bred by Alec Taylor, "Dick Swiveller," now 7 years old, belongs to Mr. N. C. Awburn, of Haydon Bridge. The next on the list is an aged horse in the full sense of the term, having reached 17 years. This is the "Duke of Athole," by "Breadalbane," out of "Countess," by "Rataplan," consequently well bred, and with a jumping strain on the dam's side. He stands just $15 \cdot 2\frac{1}{2}$, has great bone, is very wide across the loins, and deservedly attracted a good deal of attention. If his legs show signs of hard work, it is through

his exertions on the road, and not on the Turf, as for some years he has been drawing an omnibus in Lincolnshire, his duties being only varied by having a "holiday in a dog-cart." Major Godman's four-year-old, "Duke of Sterling," by "Sterling," out of "Wild Duchess," by "The Duke," stands a little high on the leg, and is somewhat light, but moves well; his Turf record is *nil.* Number 8 on the Catalogue, "Even," a brown horse by "Quits," out of "Evelyn II." by "Carnival," was the third of the reserved ones. This horse *ought* to make a hunter sire, not because his sire, "Quits," was a hunter, for he was only a hunter on the *lucus à non* principle; but because of his breeding. "Quits" being by "Restitution," "Even" inherits the "King Tom" and "Harkaway" blood, while through "Worthless," the dam of "Quits," comes the "Sir Hercules" strain, which always tells in favour of jumping. "Even's" own recommendations include good shoulders, back and loins, and those who are in favour of length in front of the saddle should admire this horse, for he has plenty of it; almost too much in the opinion of some of the critics. The Duke of Montrose bought "First Flight," by "Pellegrino," out of "Flippant," by "Cape Flyaway," for the use of his tenants. He stands 15·2½, but has not over much bone. Mr. Annett's chestnut horse, "Fitzroy," by "Muncaster," out of "Rosy Morn," by "Rosicrucian," is a bigger horse than "First Flight," measuring, I should say, nearly 16 hands. He was bought from Mr. Martin, of Newmarket, last August. His quarters are open to the charge of being a little common, but he has good flat legs, and is fairly off for substance. The above constituted the first batch, of which "Blue Grass," "Dick Swiveller," "Duke of Athole," "Even," and "Fitzroy," were most approved by the Judges, and so were told off for examination by the veterinary officials.

The second ten brought in were in every respect superior to the first division, a couple of the premium-takers being amongst the second batch, and two more which, so far as appearance went, were likely to take prizes. The first to be noticed is Mr. J. Goodwin's "Gumbo," by "Macaroni," out of "Lynette," by "Lord Lyon." After being used for one season at the stud at Mentmore, "Gumbo," formerly the property of Lord Rosebery, was sold at auction for 500 guineas to his present owner, who has the reputation for knowing a hunter when he sees one. "Macaroni" horses have not always the best wearing legs; but "Gumbo" shows no signs of failing in this important particular. True, his career on the Turf did not involve hard work, as a couple of mile races (one at Ascot, and one at Goodwood) when a three-year-old, is the sum-total of his labours, and he retired without

having won a sixpence. "Gumbo's" colour is black-brown, and those, who are given to connect a sprinkling of grey hairs with the possession of stamina, will see in the horse an additional attraction. At present he is untried as a hunter-sire; but if make and shape go for anything, he ought to get hunters, as his shoulders are good; he is deep through the heart, and has good back, loins, hocks and feet. I was not particularly taken with Mr. Calder's "Haphazard," by "Moulsey" or "Landmark," out of "Stolen Moments," by "Melbourne." He seemed more of the park hack order, and wanted another rib. For many years the hunters at Birdsall have had a high reputation, and "King Harold," by "Thunderbolt," out of "Edith," by "Newminster," is a horse of Lord Middleton's for the use of the tenantry. He is a nice compact horse, with decent if not first-rate shoulders, but he did not show much muscle on his second thighs. "King Harold" did not move with enough liberty; but as the flooring was not well adapted for showing off a horse's paces, it might, under the circumstances of the case, be unfair to criticise the action of the horses too minutely. Mr. Pallister's "Knight of Athol," by "Knight of the Garter," out of "Blossom," by "Blair Athol," was not without his good points, but could hardly be called a hunter-sire. Then came an old horse-show acquaintance in Mr. Stephenson's "Knight Templar," by "The Baron," out of "Miss Croft," by "Thormanby." His Turf recommendations are as good as those of any sire shown against him. He is now 13 years old, having won the Beverley Cup ten years ago. When 6 years old he ran sixteen times, and took part in several hurdle races. The fact of his having run up to the time that he was 7 may account for his joints being somewhat round; but when he took leave of the Turf he was often ridden to hounds, and proved himself a good hunter. That he should have passed the veterinary examination after so laborious a career is much to his credit. To come to his appearance in the show-ring, "Knight Templar's" weak spot is his forelegs, which are not of the best, and one of them is not quite straight. No one would wish to have better shoulders in front of him, or a better back under his saddle, while his head is well set on.

It was bad judgment on the part of the attendant of Mr. Brennand's "Lancer," by "Maccaroni," out of "Lancet," by "Skirmisher," to bring his horse into the ring with a great roller on, as his trappings detracted considerably from the appearance of his forehand. He is a big horse, standing rather over 16·1, and is by no means deficient in substance. I thought he turned out one of his toes a little and did not walk very free; but many good judges seemed to like him. Mr. Simpson's "Lord Derby," by the "Miner," out of "Nector," by "Neville," was

one of the veterans of the show, as he was foaled in 1869. With his rough coat and light middle there was nothing very imposing about him; but he is not without good points, and seems a wiry little horse. He has, I am told, been serving round about Northallerton, and report speaks well of his stock, all of which jump, a characteristic they possibly owe to "Neville," the dam's sire. Mr. W. Taylor Sharpe's "Mar," a chestnut by "King Tom," out of "Marsworth's" dam, by "Fernhill" or "Gleam," is a sire with great bone, and shows much power in his back and loins. With excellent sloping shoulders and hocks well let down (one of them blemished by accident), he is by no means a bad specimen of a hunter-sire, and the general opinion was that he would be found among the first five, *malgré* rather weak pasterns. Mr. John Dawson's "Marsala," by "Plebeian," out of "Madeira," by "Thunderbolt," is leggy, and does not fulfil the requirements of a hunter. Mr. Sawrey-Cookson's "Mr. Winkle," by "St. Albans," out of "Peri," by "Birdcatcher," is just the sort of horse that one would like for a hunter-sire. He stands, I should say, about 15·2, and is a wonderfully strongly built and compact little horse, second to nothing in the hall in point of good looks. He has enough bone for anything, capital shoulders, a good back and loins, and good quarters. He has been standing in Durham, where he has got some excellent stock, and has established a great name for himself.

The third batch were led by Mr. Banks's "Moss Hawk," by "Blair Athol," out of "Vergiss-mein-nicht," by "The Flying Dutchman." "Moss Hawk" is a nicely topped horse, and his fine forehand was much admired by those who gathered round his box before the judging began. Nor was he less liked when he paraded in the ring, as his bloodlike appearance was all the more apparent. If there is a fault to be found with him it is in his hocks, but the shortcomings did not seem to be very serious. He was eventually found among the first five, though, like some of the other winners, he brings no character with him from the racecourse, as he failed to win a two-year-old race after seven attempts, and was equally unsuccessful in his two three-year-old races. "Omega," by "Knight of the Garter," out of "Lambda," by "Umbriel," the property of Mr. Trenholm, has a great local reputation in Durham. His pasterns are too long to be deemed perfect, and his quarters, rather too drooping to be esteemed handsome, are well shaped for jumping. *On dit*, that "Omega" last year served more than 150 mares; a good many of his stock were seen at various shows last season, and it is only fair to say that they gave promise of growing into hunters. "Omega" is a cobby sort of a horse,

with plenty of bone, and good riding shoulders, but he has a plain head and neck. "What's the odds," however, as the Yorkshire dealer said to a would-be-buyer who complained of the size of the head of a horse submitted to him, "a horse don't go on his head"—at least he is not supposed to, though a season's experience in the hunting field leads one to conclude otherwise. Mr. Sawrey-Cookson's "Prestonpans," by "Prince Charlie," out of "Beatrice," formerly the property of the late Mr. Gretton, though entered for competition, was subsequently withdrawn, and exhibited with those stallions "not for competition," while No. 24 ("Pirate Chief") was likewise absent, owing to an accident having befallen some one connected with him. "Plumbago" is a bloodlike horse, but did not strike one as anything out of the way. Mr. Wallis's "Prescription," by "Carlos," by "Knight of Kars," out of "B. M.," stands very nearly 16·2, and, I was given to understand, has never been ridden. Critics by no means agreed with each other in their estimation of him. Some thought him rather lumbering and coarse, and more fitted for harness than saddle; others liked him, and regarded him as the probable winner of one of the premiums. There can be no two opinions about his shoulders, which are good, while his legs are all that could be desired, and his back is that of a hunter. Prior to his visit to Newcastle, I believe "Prescription" had never been out of Ireland. "Queen's Herald," by "Trumpeter," out of "Queen Bertha," is perhaps a trifle leggy, a fault that is noticeable in most of "Trumpeter's" stock, but there is much to like in him. He has great bone, and shows a good deal of power and symmetry. "Red-Cap-Sly," by "Sincerity," out of "Birkie," comes from Scotland, where his stock are well thought of. He is built on quite hunter-like lines, and moves well in his walk, in spite of a damaged fetlock, the result of a railway accident. "Revolt," a seven-year-old horse, by "Bourbaki," out of "Fireproof," by "Arthur Wellesley," does not strike one as being likely to sire hunters, and may be passed over without further comment.

"Rockery," now 20 years old, headed the last batch brought in to be judged. "Rockery," by "King John," out of "Lady Clare," by "Wild Dayrell," is a cripple, having broken his fetlock-joint some years ago. This accident would not have interfered with his gaining a premium, had he been deemed good enough, but although he has his good points, he was not in the first eight when the awards were distributed. Major Stapylton showed "Selim," an Arab, by "Ramzes," out of "Dyanaza," a very pretty horse, "pretty" being, perhaps, the most appropriate term to employ. There was little fault to be

found with him, but whether he is or is not suitable for a hunter-sire depends entirely upon whether individuals believe or disbelieve in the expediency of an Eastern cross in hunter-breeding. In olden days Mr. Childe, of Kinlet—known as "the flying Childe"—used to beat nearly every one in Leicester on a horse by Lord Clive's "Arabian," while "Hermit," the grey horse of which Charles Davis, the huntsman of the Queen's stag-hounds, was so fond, was by an English thoroughbred ("Grey Skin"), out of a white Arab mare belonging to Mr. Gates, of The Hermitage, near Woking. A recent newspaper controversy shows that there are still many admirers of Arabs as hunters, though the result of Mr. Blunt's last sale seems to indicate that the time has not yet arrived for the average hunting man to regard the Eastern horse as the best type of a Leicestershire hunter. "Hermit," by the way, cost 160 guineas, and was ridden by Davis for nine seasons; but then the Royal huntsman was a light weight—only about 10 stone, including saddle, and the gold-lace of his coat. The patronage extended to "Selim," therefore, must depend upon how far the believers in Eastern blood act up to their theory. A Roman nose helps to spoil the appearance of "Sideral," by "Siderolite," out of "May Queen," by "Claret." "Sideral" has not quite the size or substance of his sire; yet for a little horse he has many good points to commend him, though his feet might be better. "Storm Signal," by "Thunderer," out of "Soffinka," a "Newminster" mare, is by no means a bad stamp of a hunter-sire. In colour he is a rich dark bay, he walks well, has great bone, and should find favour in the eyes of those who like big horses. "Sulieman," by "Knight of the Crescent," out of "Queen of Prussia," by "Orlando," struck one as being rather narrow, but showing rather more quality than the last-named; his shoulders and quarters are good, and he is a muscular horse, ticked with white hairs. "Swillington" (late "Willie Darling"), by "Hermit," out of "Stockwater," by "Stockwell," gained rather an unenviable name when on the Turf, through his tendency to break blood-vessels at critical moments. As a show candidate, he is not by any means at his best, having apparently lost a good deal of his muscle, and, when compared with some of the others, looking light and leggy. Nevertheless, no horse bred as "Swillington" is could be otherwise than good-looking, though some critics denied him the merits looked for in a hunter. His back and loins are good enough to carry 14 stone to hounds, and when he has spent a little longer time in the paddock, he may possibly find greater favour in the eyes of judges than that which attended him at Newcastle. From head to tail "The Muleteer," by "Mogador,"

out of "Roma," by "Oxford," is a hunter all over. He was as good a horse to follow as any in the show, and was second to none in the matter of bone. Moreover, he boasts of capital quarters, very muscular arms and good shoulders, and the Judges were evidently much taken with him. "Wallingford," by "Lord Clifden," out of "Donna del Lago," by "Lord of the Isles," is lacking in substance, and, though a useful horse enough, hardly strikes one as being quite a first-class pattern for a hunter-sire.

"Wallingford" was the last of the competition horses. As already pointed out, the most likely-looking of each batch of ten were told off for veterinary examination, and from those who survived the ordeal, the winners of the five premiums, and the three reserved horses, were selected. The veterinary surgeons were Professor Brown, Mr. Fryer, and Mr. Clement Stephenson. Of the competitors, sixteen were told off for examination, and here I may state that I do not know what were the instructions to the veterinary officials. Of one thing, however, I am certain, viz., that the examination was of a most searching description. Amongst those which returned for final examination by the Judges were "Blue Grass," "Dick Swiveller," "Duke of Athole," "Even," "Gumbo," "King Harold," "Knight Templar," "Moss Hawk," "Prescription," "Storm Signal," and "Swillington." These were again minutely inspected by the Judges, and there was a good deal of evident excitement manifested while the final choice was being made. Ultimately "Duke of Athole," "Dick Swiveller," and "King Harold," were sent out, and nothing remained but to pick the five prize-takers, and arrange the remaining three in their order of merit.

By common consent three horses were sure of being in the winning five, but opinions differed as to the placing of the rest. Eventually "Gumbo," "Knight Templar," "Moss Hawk," "Prescription," and "Storm Signal," were accounted the pick of the party, and thus entitled their owners to 200*l.* each. They were, for the purposes of the show, to be taken as of equal merit, so the catalogue order as above given must not be regarded as indicating a superiority of one over another. Lest objections and disqualifications should follow, three horses were to be reserved—of course, in order of merit—and these were "Blue Grass," "Swillington," and "Even."

It may possibly be thought that, in making mention of what seemed to be the more prominent points of the horses entered for competition, what has been written was not borne out by the decision of the Judges. The answer is that one or two horses, who seemed certain prize-takers, did not pass the veterinary

examination. The veterinary surgeons did not report the nature of the various unsoundnesses, therefore particulars cannot be given; and subsequently, the standard of soundness being very high, it was agreed that the names of the horses failing to pass should not be declared.

It would be idle to pretend that the recent experiment of the Society has not been the subject of criticism, some rather hostile perhaps. This is not to be regretted. It is wise to learn from our enemies, says the maxim; and though an enemy is too strong a term to apply to a critic, the principle holds good. In some minds there has been a feeling of disappointment at the class of horses seen at the Newcastle show, and hereupon arises the question, What is a first-class hunter-sire? With one requisite every horse at Newcastle necessarily complied—all were thoroughbred. That the sire should have no hereditary disease is of course admitted by everybody, and the veterinary inspectors at the show took great pains to ascertain that the decorated horses were sound in this respect. As with hounds, so with horses, bone is a *sine quâ non*, and the sire should also be built on the lines of a hunter, and should not merely show indications of possessing speed. These are points about which controversy can scarcely arise, but some surprise has been felt that among the entries there were not more horses of reputation. It seems to have been fancied that the liberal prizes offered by the Society would have attracted some whilom celebrated winners on the Turf. Except in the hands of a very patriotic, one might almost say Quixotic, owner, it seems unreasonable to suppose that an ex-racehorse, whose career may have rendered it probable for his subscription list to fill at a fee of from 25 guineas to 250 guineas—the latter is "Hermit's" fee—would be placed at the service of breeders in return for 50*s*. This is simply a commercial view of the case. Secondly comes the question whether a hunter-sire is any the better for having won races. It is, perhaps, well for him to have run, if only to show that he has survived the exigencies of training and racing, and is therefore possessed of limbs capable of withstanding the effects of work; but is success on the Turf any criterion of success as a sire of hunters and other half-bred horses? Where so many good judges have differed, it would be presumptuous for the writer to express an opinion one way or the other.

It might have been expected, no doubt, that horses which had won valuable steeplechases would have been entered, but there was, as a matter of fact, hardly a jumper in the show. We should of course have liked to see such horses as "Downpatrick," but Mr. Chandos Pole bought him at Doncaster for the use of the farmers in the Meynell hunt, and so might not have cared about win-

ning a prize, the acceptance whereof would involve his absence from the district for which he was purchased. "Scot Guard," too, may be doing very well where he is, and the same may be true of other cross-country celebrities, and indeed of flat racers. This statement may give rise to the retort that the condition, requiring the prize-winners to stand or travel in whatever district the drawing of lots should assign to them, has a tendency to check entries, and to keep out of sight those sires who have already made a name for themselves by the excellence of their stock, and who have a regular, and possibly remunerative connection with the surrounding breeders. To a certain extent this is true, and the Committee, when they passed the regulations, could not have overlooked the probable effect. But, as I understand the object of the show, it was not merely to gather together stallions from all parts, and to subsidise the best of them, but the intention seems to have been to bring five sound horses at moderate fees within the reach of farmers and others residing in those districts embraced by the Society's annual summer show of the same year; and it was by way of making some compensation for whatever cost might be incurred through the horse standing away from home that the premiums were set at the high sum of 200*l*. If the Committee come to the conclusion that the existing conditions limit the good which the shows might otherwise do, nothing is easier than to alter them, so as to attract the class of horse regarded as the ideal hunter-sire.

However, I am now concerned with the Newcastle show as it was, and not as to what it might have been, had the conditions been differently framed. Now that the exhibition is over is the time to ask one's-self the simple question, "Was it a success?" Financially it is to be hoped that it was; but beyond that, were the horses exhibited up to the standard of sires calculated to get good hunters and useful half-breds of other kinds? In the opinion of the writer the majority of them were. They were at any rate infinitely superior to the class of mares with which most of them may eventually be mated. Allusion has already been made to the fact that the liberality of the Royal Agricultural Society of England did not result in the entry of an "Ormonde" or a "Bard," or of any other horse within a long way of being "the horse of the century," but it is a moot point, whether an animal of that kind is necessarily a better hunter-sire than one whose racing career has been a failure. In an earlier part of this report mention was made of several sires which used to travel the counties of Northumberland and Durham; but if they and others, whose names have come down to us as celebrities, could have been gathered together at Newcastle, it is quite possible that critics would

have spoken of them, as they spoke of the horses seen in January. Some would probably have been "crocks," others would have had defective forelegs, "not the best of shoulders," and so forth. The question, therefore, seems to be, not were the Newcastle horses perfection—but did they answer reasonably to a certain standard?

To be hypercritical about sires only tends to give greater prominence to the importance of breeding from good mares. If the horses seen at Newcastle were not good enough to get good hunters, where, it may be asked, are the mares which would breed at a disadvantage if mated with any one of the Newcastle premium-winners, or reserved horses? In the "Druid's" books and in other works we read much about horse-breeding in a bygone day. We learn the names of some of the more noted sires, and learn, too, how common good hunters were; in fact, if the records are to be implicitly trusted, such a thing as a failure in horse-breeding seems never to have occurred. To draw a comparison between the hunter-sire of to-day, and his predecessor of sixty or seventy years ago, is, for obvious reasons, well-nigh impossible. To attempt to argue the matter would be to reopen the question, foreign to the present purpose, whether the English thoroughbred has deteriorated, not only in point of endurance and stamina, as some assert, but in make and shape also. In this report it has been already noticed that none of the Newcastle decorated horses have greatly distinguished themselves as winners of long-distance races on the Turf; and a note was also made of the fact that there are not wanting breeders who maintain that the ability to race over any course, long or short, is not necessarily a recommendation in a hunter-sire, whose progeny do their work not at racing, but at half or three-parts speed. But one or two remarks on the stamina of our horses of to-day may not be out of place here. Both in print and in conversation it almost seems as though writers and speakers jumped to the conclusion that 5 and 6 furlong races were instituted, because horses showed themselves unable to travel longer distances. Even the non-racing reader will scarcely need to be told that such was not the case. In these days of multiplied race meetings, a horse can be brought to the post oftener, when the course does not exceed 5 or 6 furlongs, than if he had to race from 1 to 3 miles every time that he started. Consequently short races are found to pay better, and horses are trained for short courses. But when their flat-racing career comes to an end, and they are put to hurdle-racing and steeple-chasing, they are trained in a different manner; thenceforth they rarely race less than 2 miles, and it often happens that some animal, which could not stay for half a

mile on the flat, manages to stay 3 and 4 miles over a country, carrying a weight which, in the language of reports, would be termed a "crushing impost." Unless all the stop-watches were in error over the time taken by "Old Joe" in last year's Grand National, it would seem as though the cry that the modern race-horse cannot stay is a somewhat premature one. What more ought a horse to do, before he earns a character as a stayer, than to run the Grand National course (4 miles and 1000 yards) in 9 minutes $14\frac{3}{5}$ seconds? It may possibly be objected that "Old Joe" was the only horse that did stay; but the answer is, that in the days of "Emblem," "Emblematic," "Abd-el-Kader," and others, there were always some horses that did not stay as long as the winners, and, in comparison with them, were non-stayers.

Now as to the mares. The future of horse-breeding must depend largely upon the steps taken to induce owners not to send them out of the country, but to keep suitable ones for stud purposes. If so much criticism be expended on the sires, the type of mare requisite to breed a good hunter, or general-utility horse, is surely deserving of attention. Let us see how far theory and practice agree. It is admitted on all hands that the mare must have size, as the dam's height and measurement influence the size of the foal. Many instances of this could be adduced; but I was told not long ago that "Polardine," himself a little horse, invariably got big stock when put to full-sized mares. The dam must have bone as well, while ringbone, spavin, affected wind, and sundry other shortcomings are no more allowable in her than in the sire. Now where do we find these upstanding mares to-day? If we take horse shows as our test, they will only be found either in the stables of the well-to-do who have pensioned off hunters, or harness-mares, or else in the possession of the better class of farmer with a predilection for horses. It is submitted, however, that it is not in the interests of either of these that the Royal Agricultural or the Hunters' Improvement Societies have exerted themselves. As the writer understands the matter, the aim has been to induce the ordinary farmer to breed as part and parcel of his calling as an agriculturist; and it is comparatively rarely that a non-hunting small farmer possesses a mare that could throw a weight-carrying colt, unless by something next to a miracle.

This state of things may be accounted for without much difficulty. About the year 1858 foreign buyers appear to have conceived the idea of sending agents to England to buy likely-looking mares. Mr. Elkan, of Berlin, a few years later, made many purchases, especially in the North and East of England. The prices offered by the foreign agents were considerably in

excess of those obtainable from English buyers, and were, of course, readily accepted. The advantage of having good mares was soon perceived abroad, and the purchase of them has steadily gone on, with the result that, let people say what they like, more good mares have gone out of England than England can afford to part with. There is another reason why farmers do not now keep the stamp of horse they once did. The introduction of railways, and the now common custom of running "market trains," have rendered the average farmer pretty well independent of the aid of a nag horse, except as a pure matter of convenience. Formerly farmers rode to market, and a man who is obliged to spend much time in the saddle is generally particular, as far as his means allow, as to the kind of horse he rides. In olden times a certain proportion of farmers' horses were long, low, useful short-legged mares, with fair action, of medium size, and of good substance. The call for this stamp of animal is not now felt. The train has supplanted the hackney, and riding has largely given place to driving. The average farmer can drive a worse horse than he would care to ride. A pony will do enough harness work for most farmers; but no one who dreams of breeding hunters, or horses suitable for military purposes, would dream of breeding from such an undersized mare. At the same time it is only fair to state that the experience of the recent Newcastle show seems to indicate that sufficient mares are forthcoming to fill the lists of the sires who received prizes. That they will prove to be the right sort of mares every one interested in the question of horse-breeding will most sincerely hope.

Nor must it be left out of sight that, for certain purposes, big horses are more than ever in demand, the deduction being that small horses have gone down in value. In Leicestershire, Northamptonshire, and other fast countries, even light men are mounting themselves upon big horses up to more than their weight. This is a change from olden times. When old Stephen Goodall (he rode 20 stone) hunted Sir Thomas Mostyn's hounds in Oxfordshire, he would never bestow a second glance on any horse standing upwards of 15 hands 1 inch; and many more instances might be adduced to show that, so far as the general fancy is concerned, hunters, to be of the most saleable kind, must stand higher now than formerly; and for proof of this, look, as I have just said, at the horses ridden in the biggest counties. If this be true, a very little reflection will show how heavily the average farmer is handicapped when he tries his hand at horse-breeding. The majority no longer keep the stamp of mare which used to throw decently-sized horses, and now that big horses are more than ever in fashion, farmers, as a class, keep still

smaller mares. It is a somewhat noteworthy circumstance that, while there is a growing fashion in favour of big horses for hunters, there is among all classes at the same time a greater demand for smaller ones for harness purposes. The "Village," "Rustic," "Battlesden," and "Polo" carts, which are pressed upon our notice in every sporting newspaper, are rarely drawn by any animal over 15 hands. Miniature broughams do not need the upstanding coach-horse that our grandfathers used to drive; the institution of polo has given an impetus to dealing in ponies of 14 hands; so that in one way and another there is not the demand for full-sized horses that there once was, except for the hunting field, where they are in greater request than ever. The result of this is, that the farmer has followed on the prevailing fashion of driving undersized animals, and rarely, unless he be a hunting man himself, possesses the sort of mare likely to breed a weight-carrying hunter. In company with a friend, I recently visited some inn stables on three market days, to see what kind of horses had brought the farmers to market. We found 38 mares altogether, and not more than 10 of these exceeded 15 hands: of the 10 there was only one that could by any possibility be deemed a fitting brood-mare for hunters. May not this state of things explain what is called the "scarcity of horses"? Let any one attend the periodical sales at Tattersall's, or Aldridge's in London, Tattersall's at Rugby, Warner's at Leicester, Deacon's at Swindon, or the sales at any other repository, and it will be seen that mere light-weight horses are a drug in the market, and cannot possibly pay for breeding. Any one who is content with an animal standing about 15·1 at the outside, and capable of carrying not more than about 11 stone 7 lbs., may mount himself almost for his own price. Whether breeding can be made to pay, or whether it cannot, it is at all events clear that nothing but failure will await the breeding of these undersized horses; they are consequently not the class to be encouraged.

The Newcastle show enabled people to see, if they ever doubted the fact, that there are plenty of sires about the country good enough to get the best class of weight-carrying hunters, and if breeders use the premium-winners, they have the guarantee that the horse is perfectly sound. At Newcastle there were two horses cast by the veterinary officials as unsound; yet they have been much used in their own district, and, in one case, the stock are very much liked. What the unsoundness was is not known to the writer; but does not this indicate the usefulness of the shows at which stallions are subject to a vigorous examination? The owners of the horses in question were probably in ignorance of any defect in their horses, for had they

known them to be unsound, they would scarcely have encountered the cost of sending them to a competition for which soundness was a *sine quâ non*. The unsoundness may have been slight, or it may have been great; nevertheless the fact remains that certain unsound horses have been used. The only other alternative is that the veterinary officials were wrong; but this, as far as I know, has never been hinted at, and their judgment remains unimpugned. After setting out the numbers of the winning and reserved horses, as given above, the Judges, in their report, wrote as follows:—

"We are sorry to find that some of the horses we had admired failed to pass the veterinary inspection; at the same time we fully recognise the great importance of soundness, and we are glad to be able to testify to the care and ability with which the examinations were conducted.

"The general arrangements were excellent; and the boxes in which the stallions were located were planned so well, that the public were enabled to see the horses to every advantage.

"We would suggest that, on future occasions, it might be desirable to have the horses shown on a harder surface. In the ring, to-day, the horses did not always show their action to advantage, being afraid to move on the boarded floor.

"We cannot conclude without thanking the Stewards for their courtesy and attention.

(Signed) "COVENTRY.
W. DUNNE.
EDWARD PADDISON.

"*January* 25*th*, 1887."

At all horse shows competent judging is indispensable, but in no class is it more so than in those for entire horses. Stallions are a class by themselves; and to decide on the merits of those exhibited, a greater degree of knowledge and experience is needed than any other description of horse. At the recent Newcastle show the Society were fortunate in the extreme in being able to secure three gentlemen so well qualified to act. They all possessed great experience in horse-breeding; and though around the ring were many critics, there was no quarrelling with the decisions arrived at, a state of things which cannot be otherwise than satisfactory to the Society, and one of which the Judges may well be proud.

It was a condition of the show that the districts in which the prize winners were to stand or travel should be decided by lot. The draw took place at the close of the day with the following result: "Gumbo" goes to Alnwick; "Knight Templar" to Durham; "Moss Hawk" to Westmoreland; "Prescription" to Cumberland; and "Storm Signal" to the Tynedale district.

Little more remains to be said. The Newcastle show was the first step in what may prove to be a great undertaking. In the event of those, who wish well to horse-breeding, supporting

the movement, a great deal more may be done. As an expression of individual opinion, it is to be hoped that before long substantial prizes may be offered for brood-mares belonging to *bonâ fide* farmers. But in order to encourage the keeping of the right stamp of mare, it might be well to exclude those below a certain height, say 15·2. It might be found possible to work out some such scheme as this: Allow a *bonâ fide* farmer to nominate, for the purposes of some particular show, a brood-mare belonging to one of his neighbours, to the squire or doctor, for instance, upon the understanding that if the mare won a prize she was either to be bought by the farmer at a certain price, or leased by him for a stated period for breeding purposes. The co-operation of the owner of the mare would of course be necessary; and there are, it is believed, many persons who would aid the farmer in breeding, who have not the wish or convenience to undertake the task themselves. In the event of any such plan being adopted, it might be necessary to make the nominated mares a separate class by themselves. As in the case of the sires, there might be certain conditions annexed to the right to receive a prize, and the money might be withheld until those conditions had been complied with. In short, the future of horse-breeding in this country appears to depend upon how far the majority of farmers can be induced to take the matter up. In days gone by most of them bred a foal or two every year; will those times ever return? The Royal Agricultural and the Hunters' Improvement Societies have done their best to give horse-breeding a fillip, and the result of their endeavours will be awaited with interest.

Since the foregoing was written, Lord Ribblesdale has stated in the House of Lords that he does not intend to allow the horse-supply question to drop, and that he will at a future time bring forward a scheme having for its object, the encouragement of breeding, with a view to increasing the supply that we so much need for the purposes of our army. The prohibition of the exportation of horses from foreign countries, the presence of foreign buyers at our home marts, and the renewed, and at the same time uncontradicted statements that our army is lamentably short of horses, have one and all tended to direct fresh attention to a matter affecting, in one way or another, nearly every class. Could horses be obtained in England, there would scarcely be the need to order them from Canada. It has already been pointed out that the breeding of hunters is intimately connected with the supply of army horses, and also with that of harness-horses. A good specimen of a hunter cannot be put out of his place, and so while civil associations and private enterprise seek to further the breeding of hunters, they are at

the same time doing something for the supply of army horses; while, should the military authorities lend a helping hand in order to secure a better supply of troop and artillery horses, they will likewise encourage the breeding of hunters. The commercial aspect of the case is rather foreign to the present report, but, if the farmer is to gain much benefit from the various schemes now on foot, it is to be hoped that steps may be taken to bring the farmer and the actual buyer into closer relationship. Commission is the curse of horse-dealing, as every dealer can tell us. It can never be quite done away with; but under proper supervision surely the extravagant gains of middle-men might be cut down to something like reasonable proportions.

V.—*British Dairy Farming. Two means of promoting its greater prosperity.* By James Long, of Graveley Manor, Stevenage, Professor of Dairy Farming at the Royal Agricultural College, Cirencester.

I am aware that in recommending the adoption or the further extension of systems which have been among the chief means of placing the dairy industry of the Continent in the position it now holds I run some risk of criticism at the hands of those who are not well acquainted with Continental work, and who look upon our British industry with an optimism, which is most commendable as a national feeling. There is, however, nothing like practical experience, and taking this as a guide, I have not scrupled to abandon all feelings of sentiment, when by so doing I could learn something from our cleverest competitors, and when by admitting that British dairying ranked only second or third to them I was initiated into the mysteries of their work, and generously assisted in obtaining every detail about which it was worth my while to enquire. In commencing a more complete and extended study of dairy farming for the purposes of the volume * to which my name is attached, I was compelled to recognize two cardinal points, both of which affect our future success in one sense, as they have done our past failure in another. The word failure may, perhaps, be found objectionable; but the industry that by its want of power, of energy, and of knowledge, has permitted competitors of other nations to usurp its functions so completely as has been the case, can hardly be termed a successful one. These points were: 1st, that the

* 'British Dairy Farming.' Chapman and Hall: 1885.

people of this country chiefly consume foreign produce; and, 2nd, that foreign makers have, in the majority of instances, created other resources than we possess, by which they are enabled to produce a greater quantity of milk at less cost, and to place upon the market in large numbers an infinite variety of tasty cheeses suitable to all classes, which are not only far more profitable than British cheese, but which threaten to become popular throughout the whole of Great Britain. I do not think it will be disputed that our opportunities, like our resources, are no greater in regard to dairy farming than those of France and other leading dairy countries. Although our cattle are second to none, their equals as milk-producers are to be found in the Cotentin, the Holstein, and the Switzer, yet for instruction in dairy science we have had to go to Denmark, to Germany, and to America, and for practical work to France, as well as to Denmark; whereas it is difficult to name a single important dairy implement or machine now in use which is not the invention of a foreigner. The truth is, that during the more prosperous reign of agriculture in Great Britain dairy farming was too lightly estimated, and it was then that it was persistently pursued by the Continental farmer. Now, when altered circumstances induce us to turn our attention to this despised branch of the farm, we find, and naturally so, that except in a few particulars—for British cheese maintains its fame—we are to a large extent dependent upon other nations for the knowledge of how to compete against them with success in our own markets. That knowledge must be disseminated throughout England. I am aware that in France and Denmark we have formidable competitors in the butter-making industry, to say nothing of Holland and her trade in butterine. The butter question, however, has numerous able exponents and advocates.

The especial object of this paper is to show that more milk can be obtained by a system of forage cropping upon suitable soils, than by the ordinary system of grass or root farming, and that by its adoption the cost of production is largely reduced. With this view I have treated at length upon those varieties of green crops which are least known or little appreciated for milk production in this country, and with which I am practically acquainted. I have also attempted to show the importance of the Continental cheese-industry, selecting for this purpose three of the leading varieties, the Gorgonzola, the Camembert, and the Brie, as well as a skim-milk cheese based upon the Livarot and the Limburg, but, as I think, an improvement upon both. I believe that the adoption of forage cropping, as well as of soft cheese-making, will be a large factor in the success of any dairy-farmer who undertakes the work. At the same time I would

urge every one to examine either system for himself, and see what those people can do who have already had experience. In Italy I found that in September the dairy cattle were chiefly fed upon the leaves of the elm. Men who cannot obtain green food are thus induced to utilize what we despise, and yet they find no ill result. In Switzerland, Mr. Page, Director of the Anglo-Swiss Milk Company, feeds upon cut grass only in summer, and the average among his 40 Swiss cows exceeds 800 gallons of milk. What is done in other countries will be seen further on. Of one fact I am quite sure, that those who have successfully tried either system of cropping referred to here, will endorse the recommendations I have made.

Maize.

The cultivation of maize in England by the practical farming community depends upon two considerations—the belief in the possibility of its certain growth, and the assurance that it can be grown at a profit. There is, fortunately, now little difficulty in showing that the uncertainty of the crop is reduced to a minimum, and that its profitable nature is beyond doubt. This minimum of uncertainty relates chiefly to the North of England, for observations extending over several years lead me to believe that south of the Trent maize germinates and grows almost as readily as the cereals common to this country. The further we go north, however, the greater the difficulty, not because the plant will not grow, but because the season in which it flourishes is narrowed so that it cannot be sown until the summer is too far advanced to enable it to yield a profitable return. Like certain other plants, maize has been recommended very strongly, and attempts have been made to introduce it into our system of agriculture at least once in every generation, but our forefathers had not the advantages which we possess in the use of seed which has been practically acclimatized. In America the maize plant is being gradually pushed north, hardier varieties have been produced by selection and cultivation, and it is to these that we owe a capacity for maize-growing which I do not believe is yet comprehended. In some districts of France, maize forms part of a regular rotation; while in others it is grown where a rotation is practically ignored, and where the farmer's entire aim is to produce heavy forage crops for his cattle, in preference to cereals for sale. It is cultivated on the majority of warm soils, and is the most prominent plant in the Sologne, where I have seen it growing luxuriantly on lands, which not long before were peaty swamps or wild commons, covered with heather and gorse. As, however, the maize plant

requires lime, the soil should be slightly calcareous, or lime must be added. There is no crop which of late years has been so successfully grown by the French farmer in this district, and which has at the same time made him so profitable a return. It is planted in three forms—by drilling at a depth of from $2\frac{1}{2}$ to 3 inches, by dibbling when two seeds are placed in the hole, or by broad-casting. When drilled, it is necessary that the machine should be provided with cups sufficiently large to take up the seed, and to deposit it regularly. The usual quantity allowed in France is one bushel per acre, the drills being 2 feet apart, and the plants, when the seed is dibbled, 1 foot apart; but the systems vary, for the Dutch farmers, who, as I can testify, grow maize quite as well as the best farmers in France, place their seed 6 inches apart, and in rows which are only 20 inches distant from each other. In Holland the seed is commonly tested before it is sown, and the date of sowing is about May 12th, the French sowing a little later, where the crop is used for forage—the references to maize in these remarks not applying to the crop as grown for seed. In each case, however, the growers make a point of being guided by the weather. If favourable, they sow early, or soak their seed in water or liquid manure; but both soaking and early sowing are risky, where there are late frosts, which the young plant finds it difficult to withstand. A Dutch farmer, a man of great experience, Herr Boeler, whom I visited near Kampen, makes a practice of early sowing, and of protecting his plants when they appear above the surface by lighting peat fires to windward of the fields. He stated that he had found in practice that the smoke which was carried over the plants entirely preserved them from frost, whereas those of his neighbours who allowed them to take their chance were invariably damaged. Although maize drilled or dibbled is generally taken as a cleaning crop, it answers the same purpose when broad-casted, from two to three bushels of seed being used. In this way it smothers all weeds which spring up; it furnishes almost an equally large bulk of fodder; and it has this advantage, that the stems are finer, more tender and more beneficial to the cattle which consume them. My friend M. Henri Cottu, who is a great advocate of maize cultivation, regularly grows a crop in this fashion, and I have seen upon his property, near Tours, huge giant crops of maize in two successive years upon the same field, they having been the third and fourth crops which he had taken in succession upon the same soil, although it is fair to remark that he had called in the aid of artificial manure. Maize has a tremendous power of absorption, and the manure put into the soil for its growth

must be absolutely active and available. It is for this reason that, whether it is taken as a second crop or not, the land is manured in the autumn to the extent of some 16 tons per acre. In addition to this practice, M. Lecouteux, one of the leading authorities in France, recommends that, at the time of sowing, 3 cwt. of superphosphate, and ¾ cwt. of sulphate of ammonia should be added per acre. He prefers to provide the nitrogen required by the crop rather than to trust to its extraction from the air, as it does not appear to be yet decided whether the maize plant obtains its nitrogen from the atmosphere or from the soil. The seed-bed, to be perfect, should be humid and warm, and in this case the seed will rapidly vegetate, the plant appearing above the surface in a very few days; but in my own practice I have found that it did not appear for a fortnight, and that it grew slowly during the subsequent month. For the first two months after planting it is somewhat disappointing, and apparently promises a failure; but after this period it grows rapidly, unchecked by drought, which it has great power of withstanding, until it reaches its extreme height towards the end of September, before which time, cutting may be commenced. Although a splendid plant for providing green food during a hot summer, when everything but lucerne fails, few plants respond so readily to liquid manure or even to water. To obtain a maximum crop of maize, the land should not only be good and suitable, but it should be cultivated by autumn ploughing and spring harrowing, unless a spring crop is taken, when this somewhat diminishes the yield. The seed-bed should be fine and well rolled, so that the drill may deposit the grains as evenly as possible. Drilling should always be succeeded by rolling, one important reason being that, when attacked by crows, as the crop is certain to be, the birds find greater difficulty in pulling up the seeds, which they endeavour to do by tugging at the plant. When the maize appears above ground, it is horse-hoed, the same implement going between the rows a second time a month later, after which the crop is hand-hoed between the plants when they are about a foot high. At this time, too, the earth is drawn about their roots, to protect them against heavy winds. It is a strange fact, however, that though the tallest maize plant may be blown almost completely over by the wind, its feelers or rootlets will still grasp the earth, and will continue to maintain it in the position which it has assumed. In some cases it is the practice to commence to cut a large crop of maize when it is 3 feet high, and as the rows are cleared, the land is ploughed up, and a catch crop is taken. This I have known done with considerable success for a third crop, which many Continental farmers make a point of obtaining. It is only conducted, however, where great necessity

exists for continual green food. I have seen numbers of crops of maize grown in a similar manner to that described; among others, by M. Boeler, before named, in Oberyssel, Holland, who produced some 35 tons per acre as a second crop in a field of many acres in extent, the plants being grown on the ridge; by Professor Lecouteux himself at Cerçay, where the plants averaged 10 feet in height, covering a very large acreage; by M. Goffart, at Burtin; by M. Hallo, at the Colonie of St. Maurice; and by innumerable growers of lesser repute in France, Switzerland, Italy, and above all in England itself. That there is no difficulty in obtaining these large crops in England is undoubted, providing a well-selected variety of seed, such as the Giant Caragua, is used, and precautions are taken to protect it from the crow, which seems to be its only enemy. My own crops in 1885 and 1886, grown after tares upon very poor land, were most valuable, although they failed to reach 20 tons per acre, and were more than decimated by the attacks of crows, which in the first-named year carried off the entire crop planted by Sir John Lawes, by Mr. Abel Smith, M.P., as well as by Mr. I. N. Edwards, of St. Albans, who used some of the seed which I had imported. These plantings were all in Hertfordshire, where crows seem to be maintained by reason of the superstitious legend which attaches to a rookery, rather than be destroyed on account of the immense damage they do the farmer. In the latter year the same seed, which produced only a moderate crop upon my own poor land, yielded the most marvellous result that I have ever seen in this country upon the land of my neighbour Mr. Flitton, near Baldock, which is extremely fertile, and which was also highly manured. The crop was stupendous, and its proportions entirely beyond his means of consumption, equalling many of the most luxuriant maize fields to be seen abroad. In this gentleman's case, as in that of almost every other grower who has once tried it with success, it will in future form a portion of his system of cropping. The French, like the Americans, have two systems of preserving maize: one is to chop it fine, and convert it into ensilage with a pressure of from 80 to 100 lbs. per square foot, and the other is to tie it in sheaves, which are formed into cocks in the field. Where the giant maize is used, the cock is composed of about six sheaves, weighing 55 lbs. each; but with the small maize ten sheaves are adopted, these weighing only 35 to 45 lbs. each. When it is intended to preserve maize in this fashion, it is never cut until it is in flower, otherwise it rapidly decays. The sheaves, as they stand in cocks, are tied round the head, and sometimes they are covered with a second lot of sheaves, which are tied in a similar manner, the latter protecting the former, and yet so arranged that air passes freely through

them. In this way they stand for two or three months, and are readily consumed by cattle, horses and sheep; but a greater amount of nourishment is lost if the sheaves remain longer than if they had been placed in a silo. M. Crevat, who is a great disciple of this system, says that maize provides the chief item of food for his stock during nine months of the year. He gives it green from July to October, dry from October to January, and in the form of silage from April to July. The general cost of cultivation in France is sometimes 13*s.* to 14*s.* per ton, from planting to putting in the silo, but considerably less where the crop is consumed green. In my own case I have found that, exclusive of manure and rent, the cost has not exceeded 2*l.* per acre, this including a bushel of seed, ample hoeing, bird-scaring and cutting, and yet it has been taken as a second crop. The favourite crop preceding maize abroad is rye, but it is sometimes taken after winter oats and vetches, and in the majority of cases it is an easy matter to get off an early sown crop of winter vetches in time to put the maize in.

Among many other cases which might be quoted are those of Mr. Stannard, of Elmstead, who grew 35 tons of 9-foot maize in 1881; Mr. Bateman, who has grown 30 tons; and a Kentish gentleman, who grew three lots in the past year after a crop of rye, which he fed down, subsequently manuring the land heavily. In this case 10-inch drills produced 20 tons by weight, and 20-inch, 17½ tons; while small round maize, grown at 20 inches apart, produced 19½ tons by the end of August. At the last weighing, however, the 20-inch horse-toothed maize had gone far ahead of the others, yielding a marvellous crop. It is thus apparent that a huge bulk of splendid food can be obtained long before September sets in. M. Goffart, who some time since gave particulars of fifty farms upon which he knew maize to be grown, stated that the lowest crop he ever knew was 6 tons to the acre, the highest having been 40 tons. On the farm of M. Cottu the last three crops on the same soil yielded 25, 28, and 22 tons respectively, and in the same season I saw similar broadcasted crops at the French farm school of Pilletière and at the Agricultural College of Grignon. In some districts it has been the practice to imitate the French, who grow pumpkins between the rows of maize, by the introduction of swedes; but this plan is not a success, although it may be adopted as a precautionary measure, the swedes being utilized if the maize fails.

In feeding maize to milking cattle I have found only one precaution necessary, *i.e.*, the addition of a small amount of cotton-cake—2 lbs. daily—to prevent looseness. The plant was cut once a day, laid in bundles, and in twelve hours carried to the

animals on the pastures; and it was always greedily devoured without a vestige of waste. During the time of its consumption cheese-making and butter-making progressed briskly, several varieties of cheese having been made. If it were necessary to state that any difference occurred in the quality of either butter or cheese, I should say that both were better than at any other time of the year, while the flow of milk was splendidly maintained, and, speaking from practical experience, I would rather be without any other kind of food during September and October than without maize. According to the French table compiled by M. Sabatier and quoted by M. Lecouteux, maize composed as follows—

Nitrogenous matter	1·85
Fat	·056
Starch, sugar, &c.	7·18

is valued at 9*s.* 6*d.* per ton—the nitrogenous portion being valued at 5*s.* 1*d.* at the French estimate of 3¼*d.* per kilogramme, the fat at about 1*d.*, and the starchy matters at ½*d.*, the basis taken being upon average hay valued at 48*s.* per ton. Analyses of maize, however, vary considerably. M. Grandeau gives the comparative analysis of M. Goffart's maize thus; albuminoids, 1·22; fat, ·25; soluble carbo-hydrates, 10·41; sugar, ·58.*

As showing the value of maize for stock, when grown upon a system under which cereals form no part, the case of M. Moreul may be quoted. This gentleman occupies 60 acres of land, divided into three plots: 15 acres grass, 22½ acres lucerne—which remain for six years—20 acres maize, and 2½ acres cabbage—the maize and cabbage forming one plot. At the end of each six years the maize-crop and lucerne-crop change places, so that there is practically no rotation system adopted. Here maize reaches a crop of some 30 tons per acre annually, and enables M. Moreul to do extraordinary work with his small quantity of land. M. Lecouteux himself showed me his system of cropping at Cerçay. He has a six years' rotation of forage-crops, which occupy 142 acres of land, lying within a radius of a quarter of a mile of the farm, so that the cost of carting is minimised. This acreage is divided into twenty 3-acre plots, outside of which are his pastures and cereals. The rotation is as follows:—First year, maize manured with dung and phosphates; second year, tares; third year, trifolium incarnatum, planted in August and September after tares, and followed by cabbage; fourth year, potatoes, well manured, with swede turnips sown between the rows after moulding up; fifth year, oats; sixth year, clover, this crop having been manured with phosphate of lime. The following table, compiled by

* 'Silos for British Fodder Crops:' 'Field' Office, 346, Strand, W.C.

M. Lecouteux, shows the quantity of nitrogen and nourishing matter per ton and per hectare of the different varieties of forage-crops which he grows, together with the relative nutritive value of each. I have adapted it to British weights.

	Crop. Per Hectare. 2·472 acres.	Per Ton of Forage.		Per Hectare of Forage.		Relative Value.
		Nitrogenous.	Non-Nitrogenous.	Nitrogenous.	Non-Nitrogenous.	
	Tons.	lbs.	lbs.	Cwt.	Tons. cwt.	
Green maize	80	27	254	19	9 0	9·41
Potatoes	15	47	470	6	3 3	9·95
Swedes	15	29	216	4	1 9	7·38
Vetches	20	79	155	14	1 8	1·97
Cabbages	40	56	198	20	3 10	3·52
Oats (grain)	2½	270	1388	9	3 0	6·34
„ (straw)	4	79	814			
Trifolium incarnatum	15	61	180	8	1 4	2·96
Clover	20	79	180	14	1 12	2·28

Upon the average of the above crops the relative nutritive value is 1 to 4·90, as nearly as possible equivalent to good hay, and consequently the type of food for milking cattle. The nitrogenous matter yielded by the various crops is as follows:—

Nitrogenous Matter per Hectare of 2½ acres.

Cabbage	1 ton.
Giant maize	19 cwt.
Vetches before flowering and red clover	14 „
Oats, grain and straw	9 „
Trifolium incarnatum	8 „
Potatoes	6 „
Swede turnips	4 „

It is thus seen what an immense quantity of nitrogenous matter is taken from the soil when double or triple cropping takes place, trifolium and cabbage extracting 28 cwt., and trifolium and maize 27 cwt. Let us now deal with the nutritive matter obtained from the three leading crops, *i.e.*, those which yield the largest amount of nitrogen.

	Tons per Acre.	Nutritive Matter per cent.		Nutritive Matter per Acre.	
		Nitrogenous.	Non-Nitrogenous.	Nitrogenous.	Non-Nitrogenous.
				lbs.	lbs.
Cabbage	16	2·5	13·9	900	5004
Maize	20	1·8	7·7	830	3482
Vetches	8	3·1	7·6	558	1368

The nitrogenous material in the maize, 830 lbs., equals about 133 lbs. of nitrogen. Assuming that a lb. of beef, live-weight, contains 15 grains of nitrogen, it would appear that the nitrogen in an acre of maize, yielding 20 tons, is equal to the production of 436 lbs. of beef; but naturally this would only be in case the food were used in a properly balanced ration, the maize according to the above being in the ratio of 1 to 4·19. M. Lecouteux pursues this enquiry further, and upon the basis of the calculations of M. Crevat, he takes the case of a young beast of a precocious feeding breed, which is fed for high production of meat from its birth until slaughtered at the age of 20 months, when it is assumed to weigh 1170 lbs., this result being brought about by the consumption of 6½ tons of hay, or its equivalent. For every 100 lbs. of nitrogenous matter consumed in this food, it has returned 85¾ lbs. of meat, so that replacing the hay by maize of the giant variety, yielding 864 lbs. of nitrogenous matter per acre, which is slightly greater than the quantity estimated above, we get a result of 740 lbs. of beef. Although, as the French savant has assumed the maximum in his calculations in this instance, it is scarcely a typical case, yet it is a valuable instance, as showing the capacity of the maize plant under given conditions. Coming to the production of milk, and again taking a return of 20 tons of maize, yielding roughly, for more convenient calculation, 800 lbs. of nitrogenous matter per acre, it follows that if 1 lb. of nitrogenous matter yields 5·65 lbs. of milk, we get per acre 4520 lbs. of milk, equal to 440 gallons.* Again, if as shown by M. Crevat a ton of good hay, with a well-balanced ratio containing 190 lbs. of nitrogenous matter, produces 107 gallons of milk, then 15½ cwt., which is the annual average yield of a hectare of the various forage crops grown by M. Lecouteux, would produce 1074 gallons of milk, and 146 lbs. of veal or beef to the live-weight of 811 lbs. This result in English measure would mean 430 gallons of milk and a calf per acre. These calculations must be taken in connection with

* Thus although maize is a heavy and valuable feeding-crop, it is deficient in nitrogen, and to obtain a sufficient and much larger quantity than most cows can conveniently eat would be requisite. If, however, we add 2 lbs. of decorticated cotton-cake, we get the following results, a valuable ratio, and a sufficiency of solids for almost all ordinary cows :—

	Albuminoids.	Fat.	Carbo-hydrates.
120 lbs. of Maize	1·45	·60	12
2 ,, Cotton-cake	·82	·10	·42
	2·27	·70	12·42
		15·39	

the situation of the land, its quality and size, and the quality of the cow, for M. Crevat, in his 'Alimentation rationnelle du bétail,' remarks that he has found small cows yield more milk than large ones, in proportion to their size. Where a 6-cwt. cow yields 466 gallons, a 12-cwt. cow only yields 744. Well may M. Hèuze say, 'Un champ de maïs est une fabrique d'engrais. Tant prospérera cette fabrique de matière première, tant vaudra toute la production agricole.' * If it is true that, chemically speaking, those foods are the most valuable which approach in the nearest degree the requirements of the animals for which they are intended, both as to their constituents and their facility of digestion, then maize must upon these grounds be one of the most profitable crops which can be used; but how much more so is this the case when we consider the bulk it produces, the fact that it can be taken as a second crop, and the facility with which it can be cultivated! If 275 lbs. of green maize is equal to 100 lbs. of hay, to 500 lbs. of turnips, to 59 lbs. of oats, it follows that a 25-ton crop, certainly not a maximum crop, is equal to 9 tons of hay, to 35 quarters of oats, and, at the rate of 15 tons to the acre, to 3 acres of turnips. It is a curious fact, that, although maize does not flourish in a low temperature, yet it germinates at as low as 43 degrees, as shown by experiments made by Dr. Sturtevant at the New York Experimental Station. According to MM. Thomé and Sachs, the growth of maize begins at 48·9° Fah.; but in a series of experiments made by Dr. Sturtevant, he found that of the various temperatures it requires the following number of hours to germinate:—

Experiment.	Average Temperature.	Highest Temperature.	Number of Hours required for Germination.
1	52·1	55·5	140
2	48·2	50·7	168
3	45·5	47·8	264
4	43·4	43·7	233

Special apparatus was prepared for the purpose of the testing. With regard to ripening maize in this country for the seed, I am strongly of opinion that certain varieties of seed can be acclimatized and adapted to our climate, as they are being adapted to the Northern States of America. I have had numerous ripened cobs sent to me from different parts of the

* A field of maize is a manure factory, and the produce of the farm is valuable in proportion as this factory prospers.

South of England, and in the past year a friend, who had brought a number of varieties of maize from America, grew and ripened the seed of a number of them with ease. Mr. Frederick Fayne, of Moyles Court, Ringwood, however, in a statement made some time ago, entirely sets the matter at rest by what he has accomplished. He says:—

"It may interest readers to know at a time when attention is being attracted to maize as a material in a green state with which to fill silos, that I have this year ripened the above corn on a measured piece of ground at the rate of thirteen sacks to the acre, the grain being much finer than any in the market. I make no deductions from this fact, but may add that I have never failed to ripen this corn in the West of England for forty years."

As a silage crop, maize is of great value, although its disagreeable condition when taken out of the silo makes it most objectionable, and it seems to me moreover an improper food to be used within the range of milk. I have seen it prepared for the silo in a very large way by the best French siloists already named, and I had the advantage of seeing it in several silos in England during my tour of inspection as one of the Judges appointed by the Royal Agricultural Society to award the prize given by Sir Massey Lopes for the best silo. Its value as a food has been discussed by M. Lecouteux in Le Maïs,* and by M. Goffart whose cattle are a fairly conclusive proof of the correctness of his opinion and the soundness of his practice. The silo will perhaps eventually be the medium of still further encouraging the growth of maize in this country.

Sorghum.

Like maize, sorghum is a tender plant, flourishing only during the warm season, and demanding a summer of sufficient length to enable it to develope. How far north it will grow I have no means of ascertaining, but easy tests have frequently been made in the south by sowing a handful of seed in an open garden. That it will grow where maize will grow, and as far north as the Trent, I believe there is no doubt; but whatever may be the capacity of the plant, there can be no question that in the colder climate of the northern counties a test experiment should be made before land is seeded down.

The general use of this giant forage plant for dairy cows is only a question of time, for it is not only one of the heaviest croppers, but in a suitable district it is one of the easiest to grow, and there is no succulent food which is more relished by cattle, or upon which they thrive better, so far as a limited experience

* 'Le Maïs et les autres fourrages verts, culture et ensilage.' Paris, 1883.

of two years can determine. Sorghum saccharatum is the plant which is sometimes called Chinese sugar-cane, and very much resembles the maize plant. It grows almost as tall, but is much finer in the stem. From its first appearance above ground, however, until the flowering stage, it would be difficult for an inexperienced person to tell that it was not maize. I was induced to try a crop by the representations of Messrs. Carter and Co., and, as a matter of fact, the plant did a great deal more than they said of it. The first crop grown was drilled 6 inches apart upon a piece of medium loam, which had previously been occupied by an oat crop. The land was fairly well manured, and a good tilth was obtained—the seed being put in at the rate of 10 lbs. per acre on the 6th of June. The seed is not unlike enlarged buckwheat in shape, but it is a very bright black, and is liable to adhere together in small bunches, making it somewhat difficult to drill evenly. For this reason, perhaps, the French plan of broadcasting is adopted; but the French sow as much as 26 lbs. to the acre, and their plan prevents what I believe to be very necessary for sorghum as well as for succeeding crops, *i.e.*, at least two hoeings. The plant appears above the surface in a fortnight, but makes little progress during the following month, when it seems rather to harden than to grow. At the end of six weeks it commences to run up, until by the middle of September it has reached a height of from 6 to 7 feet. The 1885 crop, although a most valuable one, was inferior to that of 1886, which was drilled in the same manner on the 31st of May, upon similar land, which had yielded a large crop of potatoes in the previous year, and which had not been manured. The plant came up in a most irregular manner, and there were blanks throughout the entire extent of the plot, which were owing to the difficulty already referred to. For the first six weeks there was every appearance of a failure, but by the end of July the plants showed so much vitality, that it was evident they would yield heavily, and, as a matter of fact, the crop reached $12\frac{1}{4}$ tons per acre, although at least one-third of the ground was unoccupied. The plant should be cut while the lower portion of the stem is tender and succulent, and while it is still growing, otherwise it becomes tough and fibrous, and loses much of its feeding property, and the lower portion is left by the cattle. The 1886 crop having been left standing for the inspection of a party of agriculturists on September 23rd, had passed the stage when it should have been consumed, the seed being partially formed. Nevertheless, the entire crop was consumed by chaffing, and as in the previous year, when it was eaten green, was so much relished by the cattle, that they would

do almost anything to get it. Professor Lecouteux, who has written so much, and done such good service upon his own farm in promoting the cultivation of heavy forage crops, says that sorghum, like maize, merits the title of one of the giant-plants of agriculture, whether we regard it from its height, or from the large return it makes in forage. The cultivation of the two plants is so similar, that details which apply to one are entirely appropriate to the other. In France, the green sorghum varies between 24 and 40 tons per acre. It is cut for use in August and September, and is manured in a similar manner to the maize crop. There is another advantage consequent upon the cultivation of sorghum, which is second only to its value as a feeding crop. It enables the grower to take two crops from the same land in the same season, and, indeed, as in the case of maize, there is no reason why a third should not be planted, as I have seen it, the sorghum following a crop of trifolium incarnatum, or winter vetches, and being succeeded after cutting at the end of August, while it is still young, by rape or cabbages. There is practically no risk as to the germination of the seed if it is genuine. Unfortunately this remark does not apply to the maize-crop in this country, for unless the greatest possible care is taken to protect the seed, as well as the young plants, an entire field will be destroyed by rooks in a week. These birds have an affection for the seed of sorghum, which seems to have no other energetic enemy. It was once thought that birds took maize for the sake of the sweetness of its plant, but, if anything, the young sorghum plant is sweeter than that of maize, an additional proof that the maize plant is pulled up for its seed. When sorghum is some two to three feet high the stem is exquisitely tender and sweet, and it is easy to understand that it is used in America for the manufacture of molasses. According to a report in the 'Bulletin du Ministère de l'Agriculture' the Parkinson Sugar Company, which prepares 10,000 lbs. of sugar daily, obtains 3600 lbs. per acre from sorghum yielding 12 tons to the acre. On good land, which has been well manured, there is no difficulty in obtaining a crop of 20 tons per acre, and this fact, combined with that already mentioned, should be an inducement to dairy farmers to give their attention to a plant which yields such extraordinary results in the short space of 3 to 3½ months. In the 'Field' of September 18th, 1886, a writer described his experience with sorghum, which he was cutting and putting into a silo. The crop was grown after rye, which had been twice fed on with good cake, and he declared his intention of sowing a third crop, namely, rape for the use of his sheep—the rape being

already well up on a part of the field, upon which sorghum had been cut early. The field had grown potatoes in 1883, wheat in 1884, and barley in 1885. For the rye, 30 loads of dung were put on to the acre. The sorghum was drilled 20 inches apart on June 1st. The plants were horse-hoed on July 6th, and earthed up on July 20th. On August 28th, a quarter of a rod was weighed, showing a result of 15 tons 2 cwt. 96 lbs. per acre. It was weighed again with the same result on September 13th. It is scarcely possible to present in writing a description of the extraordinary appearance of the crop when it is fully grown, and it is only when seen in this state that farmers seem to be induced to recognize its value. Compared with other forage crops its analysis is as follows:—

	Water.	Albuminoids.	Carbo-hydrates.	Fat.
Sorghum	77·0	1·6	12·0	0·3
Lucerne	80·0	3·5	7·3	0·3
Sainfoin	80·0	2·1	8·0	0·3
Trifolium	81·5	1·5	7·5	0·3
Maize	82·0	0·8	10·2	0·25
Tares	82·0	2·5	6·7	0·3
Swedes	89·0	1·5	7·0	0·2

On account of its richness in sugar, sorghum is especially valuable for using in conjunction with cotton-cake, and indeed I found this necessary, inasmuch as, given alone, it had a tendency to cause the Jersey cattle considerable looseness, as when cabbage is given in excess. This was entirely obviated by the use of 2 lbs. of cotton-cake, which made up an almost perfect ration when given to the extent of 100 lbs. daily as follows:—

	Albu-minoids.	Fat.	Carbo-hydrates.
100 lbs. Sorghum	1·60	·30	12·0
2 lbs. Cotton-cake	·82	·28	·42
	2·42	·58	12·42
	15·42		

or exactly a ration for a cow of 1000 lbs. in weight, not in-milk, and accurately balanced for a cow of small size, in full milk. The feeding-value as compared with other feeding-crops, and

taking hay as a standard, is shown by the following figures, which also indicate the comparative value per cwt. :—

	Per cwt. in Shillings.	Hay as Standard at 1·0.
Sorghum	·90	·29
Lucerne	1·16	·38
Sainfoin	·85	·28
Trifolium	·70	·23
Maize	·61	·20
Tares	·90	·30
		Rye as Standard at 1·0.
Mangolds	·63	·12
Swedes	·50	·10
Carrots	·79	·16

Professor Lecouteux divides the constituents of sorghum, and shows its nutritive relative value as follows:—Water, 76·95; nitrogenous matter, 2·34; non-nitrogenous matter, 13·71; relative nutritive value, 5·9. Hay—nitrogenous matter, 9·7; non-nitrogenous matter, 48·8; relative nutritive value, 5·0.

A careful series of experiments was made during the past year by Professor Cselko, at the model Dairy Farm of Altembourg, in Hungary, with the view of determining the feeding value, as regards milk production, of various forage crops. The cows were of the Algauer breed, a famous mid-European variety, and they numbered from 35 to 40. They were fed in the stables during the whole of the summer, and averaged 1070 lbs. in weight. Maize promoted the largest yield of milk, but sorghum produced milk of the richest quality, two varieties being used, *Sorghum saccharatum* and *Sorghum vulgare*. The figures showing the results obtained is of such value in connection with the forage plants treated in this paper, that I give a condensed translation of them (page 139).

Dr. Sturtevant, director of the New York Experimental Station, has kindly sent me his report upon his experiments with sorghum. He says it is an important question to the farmer how to adapt sorghum to the latitude in which he lives; and with a view of gathering evidence towards answering the question, a number of varieties were grown, and their conditions noted. One season's working, however, was not considered sufficient to establish conclusions which might serve as a future guide. The unusual rainfall was injurious to the best results; but the late warm autumn was conducive to the maturing of the plant. Notes were taken upon 14 varieties having a direct bearing upon their application to the economic purposes of the farm.

TABLE (condensed) showing the RESULTS obtained by PROFESSOR CSELKO at ALTEMBOURG, in HUNGARY, with reference to the FEEDING VALUE as regards MILK PRODUCTION, of various FORAGE CROPS.

—	—	Quantity of milk, per head, per day, in gallons.	Total Solids.	Fat.	Nitrogenous Matter.	Sugar.
1. Jan. 1	Beetroot, 44 lbs.; hay, 9 lbs; barley-straw, 6½ lbs.; oat-chaff, 9 lbs.; rape-cake, 1½ lbs.; rye-bran, 1½ lbs.; malt-dust, 2¼ lbs.	1·58	14·08	4·53	3·73	5·07
2. Mar. 20	Beetroot, 55 lbs.; hay, 9 lbs.; moha, 4½ lbs.; oat-chaff, 4½ lbs.; rape-cake, 1½ lbs.; rye-bran, 1½ lbs.; malt-dust, 2¼ lbs.	1·71	13·88	4·43	3·70	5·01
3. April 22	Change to the green food	1·72	..	..	..	..
4. May 1 ..	Lucerne *ad lib.*; hay, 9 lbs.; malt-dust, 1 lb.	1·81	13·27	4·17	3·56	4·79
5. ,, 15	Half lucerne, half sainfoin, *ad lib.*; hay, 6½ lbs. ..	1·88	14·07	4·57	3·74	5·03
6. ,, 28	Same as No. 5, plus 1 lb. rye-bran; malt-dust, 1 lb.	1·72	14·21	4·65	3·91	4·96
7. June 4	Lucerne *ad lib.*; rye-bran, 1 lb.; malt-dust, 1 lb. ..	1·82	14·06	4·59	3·79	5·03
8. ,, 13	Half lucerne, half grass, *ad lib.*; rye-bran, 1 lb.; malt-dust, 1 lb.	1·83	13·80	4·41	3·77	5·03
9. ,, 25	Grass *ad lib.*; rye-bran, 1 lb.; malt-dust, 1 lb.	1·81	13·92	4·55	3·66	5·00
10. July 1	Half maize, half grass, *ad lib.*; moha, 6½ lbs.; rye-bran, 1 lb.; malt-dust, 1 lb...	1·86	13·85	4·48	3·72	4·97
11. ,, 5	Maize, *ad lib.*; moha, 6½ lbs.; rape-cake, 1 lb.; rye-bran, 1 lb.; malt-dust, 1 lb...	1·89	13·55	4·31	3·64	4·94
12. ,, 15	Sorghum *ad lib.*; moha, 7 lbs.; rape-cake, 1 lb.; rye-bran, 1 lb.; malt-dust, 1 lb.	1·81	14·09	4·74	3·69	4·90
13. ,, 20	Maize *ad lib.*; hay, 6½ lbs.; rape-cake, 1 lb.; rye-bran, 1 lb.; malt-dust, 1 lb...	1·73	13·36	4·27	3·62	4·78

Most of the varieties demanded a longer season in which to mature, but considerable results were obtained. The varieties were as follows:—

Varieties of Sorghum.	Planted.	Vegetated.	Panicled.	Bloomed.	Average Height.	Size of Culm.	Condition of Growth by Oct. 24.
African Wheat ..	May 23	June 1	Sep. 19	Sep. 30	$6\frac{1}{2}$ ft.	Med. to small.	Very late.
Amber	,,	May 31	Aug. 20	Aug. 27	$8\frac{1}{2}$,,		Fully ripe.
Chinese	,,	,,	,,	,, 25	9 ,,	Slender.	Late.
Chinese Hybrid ..	,,	,,	July 27	,, 1	7 ,,	Very small.	Very early.
Dhoura Cane ..	,,	June 2	Aug. 24	Sep. 5	$6\frac{1}{2}$,,	Large.	Late.
Early Orange ..	,,	May 31	,, 25	Aug. 31	9 ,,	Stout.	Very late.
Honduras	,,	,,	Sep. 23	Sep. 30	9 ,,	Large.	,,
India	,,	June 2	Aug. 25	Aug. 31	$8\frac{1}{2}$,,	Med. to large.	Late.
Miller	,,	May 31	,,	,, 27	$8\frac{1}{2}$,,	Medium.	Ripe.
Neeazana	,,	,,	,,	..	$7\frac{1}{2}$,,	Small to m.	Very late.
Red Imphee	,,	June 1	Sep. 17	Sep. 23	8 ,,	Medium.	,,
Rural Branching ..	,,	,,	Oct. 24	..	$5\frac{1}{2}$,,	Small.	,,
Stewarts Hybrid ..	,,	May 31	Aug. 17	Aug. 25	9 ,,	Large.	Late.
White Mammoth	,,	,,	Sep. 19	Sep. 30	8 ,,	Large.	Very late.

Among the best was Amber, a variety planted on May 23rd, and which bloomed on August 27th, reaching a height of $8\frac{1}{2}$ feet. This variety ripened sufficiently for sugar prior to frost, and the test gave 12·16 per cent. of cane-sugar. Chinese cane planted the same day bloomed August 25th, and reached 9 feet in height. The panicles were 8 to 10 inches in length, and 3 to 4 inches in diameter. On May 20th, three plots were planted with early amber sorghum, with seed supplied by the Wisconsin Experiment Station. The plants were in hills 44 inches apart each way; from four to seven stalks being left to each hill. There were three cultivations; but although the season was favourable to a large growth, the plants did not reach a state of maturity for sugar-production. On October 6th, the most advanced stalks were tested for sugar with the polariscope. The seeds at this time were hardly in the milk, most of the plants being still in bloom. Later tests were made on October 19th and 24th, none of the seeds being hard. The following were the results:—

	Av. length of Cane in feet.	Av. wt. oz. stripped Cane.	Juice.	Sp. gr. Juice.	Cane Sugar by Polar.	Glucose.	Total Sugar.
Oct. 6 ..	9	19	45·1	1·066	11·98	..	..
,, 19 ..	9	19	44·0	1·068	12·16	2·81	14·97
,, 24 ..	9	22	44·0	1·068	11·95	2·60	14·55

Plots had been planted during four years, and in only one year has the sorghum reached maturity. I have noticed in Italy, as in France, that where sorghum is grown for the seed, it is planted, as in America, in hills or bunches ; but in neither case does the yield of forage approach that which can be obtained in the manner described above.

Lucerne.

The extraordinary results which I have seen obtained by means of lucerne in several districts of France, more especially where dairy cattle are fed, was an inducement to make a trial of it as a milk-producing food. I have frequently noticed, more particularly in the summer of 1885, that, when almost every other species of herbage was dried up, lucerne afforded a heavy, succulent and valuable crop, and farmers might be instanced who were enabled to carry their stock along solely by its aid. An acre of useful loam was laid out, well cleansed and brought to a fine tilth, and upon this 10 lbs. of sound seed were drilled on the 13th of April. This sowing was followed by one of cocksfoot-grass and trefoil. The plant was up in a very short time, but was irregular and patchy. In the first week in May, therefore, a few more lbs. of seed were broadcasted by means of a hand drill, from which the coulters had been removed. It was distinctly noticeable that the seeds which had not been covered, but which had sprouted, had been killed by the sun, and I have always found it dangerous to sow lucerne and leave it improperly covered. It is quite as risky to sow early, on account of the frosts, as late, on account of the sun. It may also be observed that in drilling, the seed must not be buried, or it will be lost. One portion of the crop was sown with oats, and one without. There was no perceptible difference in the lucerne-crop ; but the portion sown with grain became much more foul, and so remained. In some instances, upon a rich and suitable soil, lucerne yields a cut in the first year ; but this is a risky practice, and is felt by the plant if the winter is severe. This plot was manured with 20 loads of good dung, but the first cut was scarcely worth taking. On the 21st of May in the second year a very heavy cut was made, and a second cut on the 2nd of August. Both were extremely valuable ; and it was noticed that the lucerne rose again, and was ready long before the grasses growing side by side with it. In a neighbouring field, since ploughed up but which was then a meadow, there were about 200 very strong lucerne-plants scattered here and there, which a month after hay-time each year had risen to the height of 18 inches. Those plants suggested the appropriate nature of the soil (for the tilth is deep)

and the mixing of grass-seeds with lucerne, or more appropriately the lucerne with grass, for the grass itself had barely commenced to grow an aftermath when the lucerne was ready to cut again. Many writers and practitioners have suggested that lucerne should be drilled and kept clean by hoeing, in order that the crop might remain upon the ground for 10 or 12 years. Professor Lecouteux shows that in France it used to remain from 18 to 20 years upon the soil upon which it was sown for the first time; but after examining very many instances of the cultivation of lucerne, I believe that labour in hoeing is not only too costly, but in vain, for it is seldom possible to keep the plant clean. This being so, it will be found more profitable to let it remain 5 or 6 years, and to secure a succession by sowing it elsewhere. The chief things to avoid in a soil are absence of lime, coldness or dampness; but with a deep tilth of the right nature lucerne will not only grow well, but will require very little manure, if the land has been well prepared. Sir John Lawes very kindly showed me, some two years ago, the depth to which the roots of lucerne extended in a pit which was dug in the centre of one of his experimental plots. This was from 9 to 13 feet. The depth of root explains the cause of the vitality of the plant in hot weather, and perhaps also the source of its life—its nitrogen—for at Rothamsted Sir John says that it has extracted from somewhere, between 100 and 200 lbs. per acre in a field where wheat cannot obtain more than 15 lbs. It has been recommended, from time to time, that a straw-crop should be taken before a lucerne-crop; but as it is impossible to take too much trouble to clean the land, it would be much more to the purpose to take roots or a crop of maize. Land which is known to be foul should on no consideration be selected. A deep and fine tilth should be obtained by early ploughing and plenty of frost; and as gaps are sure to be found, whether the seed is sown in drills or broadcasted, it is worth while to prepare a garden seed-bed in order to fill them up—trouble taken in preparing a lucerne-crop being well repaid; but it is very questionable whether hoeing should be undertaken, as unless it is continued throughout, the cost of the first hoeing will almost be thrown away.

It is very questionable whether lucerne is so much appreciated as a food for milk-production as it ought to be. Its composition is nearly what a cow requires, thus:—Water, 70; fat, ·82; albuminoids, 3·82; carbo-hydrates, 13·60—the nitrogenous principle being a little in excess; but in practice I have found, as with other nitrogenous foods such as cotton-cake, that the milk was not only extremely rich in solids, but that it contained a large proportion of butter-fat—the butter produced being a

brilliant yellow, of exceedingly firm texture even during the hot weather, and containing a most aromatic flavour. Firmness in the summer is a point of great importance, and there is no doubt that both lucerne and cotton-cake are extremely valuable in promoting it. In use, lucerne was cut and allowed to remain 12 hours before it was given to the cattle, and, in commencing, a small quantity only was given at a time. The quantity of herbage cut from the acre-plot in the first year was close upon 20 tons. A hundred lbs. was allowed to each cow daily as sufficient to provide for the wants of the animal, as well as for the requirements of all the milk she could possibly produce—the average weight of the beasts being 750 lbs. If, as I believe, this quantity of lucerne is sufficient for a Jersey cow, it follows that, with a crop of 20 tons per acre, 10 cows could be kept upon an acre for six weeks; or making allowance for waste and loss, an acre of lucerne, if it could be consumed green, would keep a 750-lb. cow for a year; and if her manure were returned to it, there is no doubt that by the time the ley was ploughed up the surface of the soil would be richer than it had previously been, by reason of the increased quantity of nitrogen which had been extracted from the subsoil by the deep roots of the plant. In France a quantity of lucerne-hay is made, and I have seen it offered near Paris at the low price of 38 francs per 500 kilogrammes, or about 30*s.* per half a French ton, although it contained 76 per cent. of digestible albuminoids. Then, too, a mixture of lucerne and Italian rye-grass is sometimes sown in the autumn, in order that there may be a profitable return during the first year; the maximum seed used is from 16 to 18 lbs. of lucerne with 8 to 10 lbs. of rye-grass. M. Lecouteux has sown the following mixture upon what he terms *prairie pâture*, i.e., land which is intended for pasture, but which is mown for the first two years:—

Italian rye-grass	34 lbs.
White clover	34 „
Red clover	11 „
Lucerne	22 „
Holcus lanatus (Yorkshire fog)	11 „
Pimprenelle	2 „
	114 lbs.

or 114 lbs. per hectare, equal to 46 lbs. per acre. The inferior grass, Holcus, is largely patronised by the French, and I have seen it growing a considerable bulk of fodder in connection with lucerne. The quantity of nitrogen which lucerne contains makes it especially valuable for milk production. The French formula gives it a value of 13*s.* per ton, but it is worth con-

siderably more than this in a milk ration. The nitrogen alone is sufficient upon the basis of the analysis of the plant in its best condition for the production of a thousand gallons of milk per acre, when a very large crop is obtained. Upon this point the experience of Mr. Hunt, of Ramsay Tyrrell, who conducts his admirably-managed dairy farm almost entirely upon a system of forage cropping, is extremely valuable. An inspection of his farm in the spring of 1886 enabled me to fully understand what could be done upon the heavy soil of Essex, and in fact what he is doing. In answer to some questions put to him, he subsequently wrote to me as follows :—

"I have never gone very accurately into the question as to how many cows an acre of lucerne will feed, but I think you will find the following pretty correct. From the first cut of lucerne I obtain about 16 loads per acre; from the second about 12 loads, and from the third about 8 loads. This makes a total of 36 loads (say 25 tons) per acre. The cartloads referred to are as much as can be piled on an ordinary agricultural cart without ladders and without being tied. I have twelve cows tied up night and day in a shed, and beyond cake they receive nothing but this cut green stuff. Taking one day with another I find they consume about 1¼ load per diem. An acre producing 36 loads would therefore keep these twelve cows for 29 days. This, you will observe, bears out very closely the statement you made in the 'Field' some time ago, that 'an acre of trifolium and rye-grass would furnish 100 lbs. of fresh cut food daily to 10 cows for 33 days.' From 4½ acres of trifolium which I cut and put into the silo I obtained 85 loads, or about 17 loads per acre."

Mr. Hunt's herd in all exceeds 150 head of milking cattle, including Shorthorns, Ayrshires, Jerseys and Guernseys, and he not only cultivates lucerne and trifolium, but rye-grass, sorghum, and grass and clover mixed, which remain down for some years. Of these he grows the heavy crops with the assistance of liquid-manure, which is carefully saved and freely used. During the season, when lucerne is consumed, the cows are at their best, but putting their daily yield of milk at the ordinary return, the lucerne would enable them without their cake to produce at the rate of 870 gallons per head per annum. Allowing for the imperfect ratio of albuminoids to carbohydrates in their food, and to other evident imperfections where an experiment of the kind has not been conducted with scientific accuracy, the result is sufficient to show the great capacity which is attached to the lucerne-plant as a food for dairy cattle. If an acre kept twelve cows for 29 days, it is evident from this instance that it would keep one cow for 348 days if she could be fed upon it all the year round; but in practice lucerne should only be used in conjunction with another food, so that the cows' ration might be properly balanced. Mr. Hunt's cows consume from 120 to 130 lbs. per day.

The French autumn ration for large dairy cattle, of which

lucerne forms the principal portion, is 120 lbs. of lucerne, 3 lbs. of cake, 7 lbs. of lucerne-hay chopped with 20 lbs. of straw. In spring it is frequently used with chopped straw at the rate of 2½ pounds to 1, and in summer with maize at the rate of 1 pound to 2½ pounds of the maize.

Trifolium and Rye-Grass.

In the autumn of 1885 a piece of oat-stubble land of moderate quality, which was manured at the rate of sixteen loads to the acre, was ploughed for trifolium and rye-grass, a nice tilth being obtained. The seed was put in on December 1st at the rate of 11 lbs. of trifolium to 16 lbs. of Italian rye-grass per acre. It was broadcasted and harrowed in with a bush-harrow. The weather was favourable, and the ground was soon covered with beautiful green herbage, which remained throughout the winter the brightest piece in the neighbourhood. In the South of England, as on the Continent, it is a common plan to scratch up stubble with a harrow, and to broadcast, but there is no question that if only a shallow plough is given, this practice will be found more preferable. There is also an advantage in using rye-grass for mixing instead of sowing trifolium alone. The cows relish it much more, and thrive upon it better. The hay is also more valuable, and there is not the same necessity for ploughing up trifolium-stubble immediately after the crop is taken. In the majority of cases if this is done, there is no crop worth speaking of which can be taken during the same season, unless it is unusually propitious. Rye-grass almost invariably comes again, and if it is manured with liquid-manure a large second crop is obtained. In this instance the crop was made into hay, and yielded a little in excess of 3 tons to the acre. The stubble was ploughed up after a second cut, was again heavily manured, and sown a second time with trifolium, mixed on this occasion with a variety of the stronger grasses in order to form a ley of some years' duration, as in the case of the field adjoining. This was probably a risky operation, but it has so far succeeded. The objection to trifolium as a food for cows is a common one, and there is some reason in it, inasmuch as the stems are unusually tough and indigestible, but if it is chaffed when grown with rye-grass and mixed with roots, it is agreeably softened, and is cleaned up by the cattle which are not affected in their yield of milk or butter. The following analysis of trifolium-hay shows that the feeding ratio is not quite equal to 1 to 3. Water, 16·7; albuminoids, 12·2; crude fibre, 30·4; carbo-hydrates, 32·6; fat, ·3. On the basis of these figures it is worth 85*s.* per ton

for feeding dairy cattle, but in consequence of the excess of albuminoids, which, however, are reduced by the admixture of rye-grass, it is necessary to add to a cow's ration some of those foods which are most easily obtainable by farmers, such as roots and straw. The crop in question, trifolium and rye-grass, was as a ration equal to one part of albuminoids to three parts of carbo-hydrates, and was given to the cattle with the following mixture: the figures showing the feeding or nourishing constituents:—

RATION FOR DRY STORE STOCK.

	Albuminoids.	Fat.	Carbo-hydrates.
10 lbs. Hay	1·20	·22	3·60
28 „ Swedes	·38	·05	1·75
10 „ Straw	·45	·15	3·76
	2·03	·42	9·11

FOR MILKING COWS.

10 lbs. Hay	1·20	·22	3·60
28 „ Swedes	·38	·05	1·75
10 „ Straw	·35	·15	3·76
4 „ Maize meal	·40	·28	2·40
	2·33	·70	11·51

Neither ration is a heavy one, but being used for beasts not exceeding 750 lbs., it will be found ample for ordinary purposes in each case. For example: if 15 lbs. of digestible solids are sufficient for a beast of 1000 lbs. weight not giving milk, 11·25 lbs. will be sufficiently near the mark for a beast of 750 lbs., and as each additional unit of solids is believed to be sufficient for the manufacture of 10 lbs., or a gallon of milk, although I prefer 1·25 lbs., we have here a surplus of 3·29 lbs. of solids, equal to the manufacture of 13 quarts of milk, considerably more than the average Jersey cow gives—the cost of the entire ration being from 11*d.* to 1*s.* a day. Swedes have been invariably used with trifolium, and provided the crowns have been cut off—the milk carefully creamed by separation, and the butter made in the most cleanly and skilful manner—no trace of flavour commonly supposed to be attached to swede-feeding has been perceptible, the butter having been of the highest quality. The experience has been sufficient to show that trifolium is not only an extremely cheap crop, but

one well suited for use among milking cattle, and which furnishes an early crop of green forage.*

I have here introduced some data which, while bearing only upon one of the two subjects upon which this paper treats, is at the same time closely allied to both and to the success of dairying in general. It is useful, too, as showing that we can safely call in the aid of our national race of dairy cattle for butter-making as well as for cheese-making, provided we feed them economically, and avail ourselves of the best means of obtaining the butter which they yield.

Shorthorn Butter Test.

In March last a test was made with eight Shorthorns, six being cows aged about five years on the average, and two being heifers. They had all recently calved, were in full milk, and were fed simply on hay—the same food they had received before purchase. They were a useful lot of dairy Shorthorns, but with nothing special to recommend them but their milking properties. It will be sufficient to quote the figures of the first test, as those subsequently made were almost identical in their results. The following table shows the names of the animals, and the milk they yielded in five successive milkings :—

	Evening.	Morning.	Evening.	Morning.	Evening.
	lbs.	lbs.	lbs.	lbs.	lbs.
Roan Belle	26	23	24½	21½	20½
Roan Heifer	20	20	18½	20½	18½
Lady Jersey	22	15	20½	19½	19
Daisy	19½	21	14	17	14½
Beefmaker	17	14	15	14	13
Patchy	25	21	19½	20½	19
Giantess	22	22	18½	19	18½
Alice	21	18	22	17½	13
	172½	154	152½	149½	136

Total	764½ lbs.
Less used for cheese	95½ „
	669 lbs.
Lbs. of milk to one pound of butter	18·5
Butter-fat percentage by churn	5·3

The total was 764½ lbs., of which 95½ were used in the manu-

* During the time the cows have been fed upon trifolium and swedes the weekly record shows a butter percentage, dating from December 24th, when it rose from 4·51 to 5·07, of from 4·39 to 5·6, usually being over 5 per cent., showing a return of a pound of butter to less than two gallons of milk.

facture of Brie and Coulommiers cheese, in order to make a comparison as to the value of the milk for this purpose, as against that of the Jersey.

The 669 lbs. balance was separated in a Danish separator, which is sometimes worked by pony-, sometimes by steam-power. On this occasion it was worked by one of Hindley's vertical engines. The cream was mixed together and allowed to stand until the souring process had commenced, until, in fact, it was ripe for churning. It was then churned at a temperature of 60 degrees, and produced 36 lbs. of butter of good quality and high colour. Churning was stopped when the grains had formed, and cold water was added to harden them. The butter-milk and water was then drawn off, and a further quantity of water added. A slight turn was given to the churn, and the water again drawn off. This operation was repeated until the water ran out of the churn quite clean, care having been taken in turning the churn to prevent the grains of butter adhering together and forming a solid lump. The last water poured in was heavily salted, forming a brine, and by this means it was found that the grains of butter were practically enveloped with a fine coat of salt, which ran through the mass when made up, giving it an even salt flavour, and preventing the possibility of solid grains of salt being found in the butter, as is frequently the case when it is salted by hand on a table or on a butter-worker. The practice also prevents patchiness or streakiness consequent upon the water of the butter being attracted to the grains of salt which are imperfectly dissolved. It will be seen that the result of the test was that 1 lb. of butter was obtained from $18\frac{1}{2}$ lbs. of milk, or about $7\frac{1}{4}$ quarts. Such a result is of the greatest importance, as it is quite equal to the highest Channel Island returns, excluding those which are exceptional. It shows at least that under proper conditions dairy Shorthorns may be found of really high-class quality. These animals were not selected from any particular farm, and were merely samples of hundreds of others of a similar kind which can be found in the midland counties. The result, too, as showing the quantity of butter-fat contained in the milk, is somewhat startling, and it may be worth while to enquire, when it is possible for practical experiments to be made with the assistance of chemistry, what is the relation of the butter-fat in milk, as shown by chemical analysis, to the butter naturally obtained by complete cream-raising and churning? A strange difference appeared in the value of the milk when used for making the French cheeses referred to above. In the ordinary way 10 lbs. is used in my dairy for the manufacture of the Brie cheese—this milk being obtained from Jersey and Swiss cattle; but when milk of any other kind is used, it has been found that

$12\frac{1}{2}$ lbs. is necessary to obtain the same result. In this case $12\frac{1}{2}$ lbs. was used, but when ready for consumption the cheeses were at least one-fifth thinner than those made from the Jersey milk, so that, in spite of the large proportion of butter-fat, the solids were considerably below those of the Jersey. Again, some observations were made in using the same milk for the manufacture of Coulommiers cheese to test by another rule the quality of the milk. The curd was set with the same quantity of rennet, and at the same temperature as when the milk set is from Jersey cattle, but it coagulated in much too short a time, and fully bore out the cheese-maker's rule that more rennet is necessary for a milk rich in solids than for one which is poor. In soft-cheese making this is a most important point, as if the curd is brought before its proper time, the cheese generally becomes dry, hard and flavourless. The result of the above test is the more remarkable when it is considered that the cows were yielding a large quantity of milk, and it is an additional testimony to the statements of many Shorthorn dairymen who prefer this class of cattle for their butter dairies.

Some Continental Cheeses.

During several years of study of the leading Continental cheeses among the makers themselves, and three years of home practice conducted without the assistance of any one in this country, for I have been unable to find any dairy practitioner who has given the requisite attention to it, I have gleaned some information, which I believe may be of service to others, and I have learned, what I believe to be true, that there is more art in the manufacture of a cheese, the ripening of which is largely owing to fungoid growth, than in the manufacture of any other article of dairy produce. In a word, soft-cheese making of the highest class is not learned in a day, and if it is to obtain a hold in England it will have to be encouraged in a far different spirit than it has been in the past, when it has been placed upon a level with cream-cheese and clotted cream—although the one takes weeks of highly skilful attention to manufacture, and the other a matter of hours and little actual skill at all. I have selected three leading varieties of new-milk cheese—the Camembert, the Brie, and the Gorgonzola, and a skim-milk cheese, upon all of which I feel able to speak with a certain amount of confidence.

Camembert.

The chief perceptible difference between Camembert and Brie cheese, regarding it physically, is the nature of the *pâte* at

the time of ripeness. In the one case it is creamy in consistency, and in the other it is firm, but salvy and unctuous. At the same time, if Camembert is subjected to refinement in an apartment which is too warm, it also is liable to become thin or creamy in the *pâte*, or flesh. It may be observed that ripeness in both cheeses proceeds from the crust. When the ripening commences, if the cheese is cut, a change in the *pâte* will be observed immediately under the crust, and this change proceeds day by day until it reaches the centre, converting what was previously raw curd into cheese. There are many French amateurs who prefer Brie before it is wholly ripe. When cut, it oozes next to the crust at the top and the bottom, while the centre layer remains firm in consistence as well as defective in flavour. The same fact may be observed in a partially-ripe Camembert, the top and bottom layers being unctuous and perfect, whereas the centre is still partially-converted curd. Camembert is the only leading soft cheese which is made in a deep mould, and which is not turned soon after filling; nor is the curd all put in at the same time, for there are usually four periods of filling—the time between each filling being occupied by the cheese in draining. In visiting the large Brie and Camembert makers, who, upon the introduction of Parisian friends, afforded me every assistance which English introductions could not have obtained, I noted the variations in the systems adopted by each. The French authors, as well as the English, have written very wide of the mark in giving the necessary details of manufacture. It is quite impossible to say that any temperature is correct, that any special quantity of rennet should be used, or that the curd should come in a specified time. The practice of a particular maker can be noted, but it does not follow that this practice is adopted with success. The practical conclusion one arrives at, after experimenting with each system, is that the maker must ascertain for himself what system will enable him to do the best with his milk, and the means at his command. I found a temperature ranging in the milk when set for curd at from 80 to 90, graduating towards 86 degrees, while the curd was brought in from 1½ to 4 hours. The makers seem to have a certain control over their operations, especially where milking is conducted three times a day, and the milk is set for cheese every time without the necessity of heating. Where, as I observed was the case, the evening's milk was skimmed in the morning for butter-making, and added to the milk of the morning for the production of a half-fat cheese, the curd was not brought under from 6 to 7 hours, the rennet in every case being heavily diluted with water, and the greatest care taken to prevent the rising of the cream. Except in the Coulommiers

district, where the dairies are much dirtier than in the Camembert, I have never seen the white fungus in such great perfection as in some of the dairies near Lisieux and St. Pierre-sur-Dives. At the end of ten days this fungus is of considerable size and great perfection, thousands of cheeses in the same apartment being covered as evenly as possible, and yet there were no signs of any special reason why it should appear with these makers any more than with us. The fact is, however, that, although the operation of manufacture may be carried on in identically the same manner and in similarly constructed apartments, a maker in this country would find his cheeses entirely destitute of their requisite covering, unless by chance the fungus happened to be present in the apartment in which the cheese was made. The white fungus is both beautiful to look upon and to examine with the microscope. Having arrived at perfection, it gradually becomes covered with a blue fungus, and subsequently with a reddish-yellow. The three fungi, one above the other, in their different stages of existence or decay, give the cheese a somewhat dirty appearance, which is not improved by complete refinement. Doubts have been cast upon the fact that Camembert will keep. Here, again, the mind of the dairy-farming public should be set at rest. Cheeses made in September and October are sent out in February and March for spring consumption, and, as a matter of fact, although the Camembert is only made at two short seasons of the year, it can be obtained the whole year through. A collection of cheese brought from Calvados by myself in September of last year, and which were fully ripe at the London Dairy Show, were perfectly preserved in January, and quite as good as ever, although possibly somewhat firmer. The destruction of a properly-made soft cheese is only effected during the two hottest months of the year, and this only if they are subjected to the attacks of flies. With regard to the profitable nature of Camembert, it may be observed that, as it requires two litres of milk to make one cheese, a cow giving 600 gallons, or 2700 litres, would make 1350 cheeses, which, at 6*d.*, would be equivalent to 33*l.* 15*s.* This statement, however, requires qualification, inasmuch as it is not possible to make the cheese in perfection throughout the year without considerable and unremunerative trouble, nor do all the best Camembert cheeses realize 6*d.* The best wholesale price received by the makers for the English market appears to be 6½*d.* each, but cheeses intended for us are made somewhat larger than those for the French market, which realize from 5*d.* to 5½*d.* each. M. Roussel makes 1800 Camemberts daily, using 800 gallons of milk, or the daily average production of 400 cows. If this gentleman continues to make for no more than five months in the year, the quan-

tity of these small cheeses he places in the market, and I believe the whole go to England, is equal to 107 tons. This should be a sufficient answer to those critics who state that the industry is a small one, which would have no appreciable effect upon the English dairy system. It has been shown above that in an acre of well-grown lucerne the nitrogen is equivalent to that in 1000 gallons or 4500 litres of milk, which would make 2250 Camembert cheeses, valued at 6*d.* each, or 60*l.* 18*s.* 9*d.*; or 1000 Brie, valued at 50*l.* without the whey, although in France they usually fetch a much higher price, Bries of 5 lbs. weight selling wholesale by auction in the Paris market in September last at 7 francs each. The same quantity of milk, properly manipulated, would make 450 lbs. of butter, which at 1*s.* 3*d.* per lb. would be equivalent to 28*l.* 2*s.* 6*d.* If the separated milk were converted into soft cheese and sold at 4*d.* per lb., this would return an additional 12*l.* It is requisite to remark that these figures are based upon the assumption that, where lucerne is used for milk production, it is always cut young, the nitrogen in the plant diminishing considerably as it approaches maturity.

The great interest which attaches to the various fungoid growths on the different varieties of cheese, especially in the case of the Camembert, led me to ask the assistance of one of my colleagues at Cirencester, Professor Allen Harker, in determining their various species and conditions at certain stages. I append an extract from a letter detailing the investigations he has commenced, which promise to be of great value. Within the present month (April) I have been at the college laboratory, and have seen the magnificent growths of true Camembert fungi which he has cultivated, side by side with other growths from a variety of cheeses with which I have been able to supply, or forward to him, through the kindness of Mr. Jubal Webb. Professor Harker says:—

"Regarding the very interesting question of the growth of different species of fungus upon different kinds of cheese detailed in your paper, I have formed the opinion that it would be best to take up the investigation where the province of the cheesemaker impinges on that of the biologist, and, in order to determine the facts, to carry out a series of inoculation experiments with the several fungi on sterilized nutrient media. Such a set of experiments are now going on in the biological laboratory here, and though the time has been too short to permit of a complete report, it may be of interest to record that I have succeeded in growing on at least two solid media the very characteristic pilose white mould which you describe from the best Camembert dairies. Side by side with it are the fungi of other varieties of cheese, upon which it would be better to reserve further remark till the experiments have been fully worked out."

It is this white pilose mould, with which I used to inoculate

curd in the past autumn, which enabled me for the first time to produce the *true* Camembert, for the blue fungus has never been so difficult to obtain.

Brie.

Although much less known in England than the Camembert, the Brie is the most popular cheese in France, and it is questionable whether even an English *gourmand*, comparing the two varieties, would not give it the preference. The *pâte* is more unctuous, and the delicacy of flavour still more pronounced than in the Camembert. There is some resemblance between the Brie and the Slipcote cheese of Nottinghamshire and Lincolnshire; but whereas the one is imperfect and perishable, the other is perfection itself and will keep for a considerable time. The extent to which the French cheeses are now selling in England is a sufficient proof that our people appreciate them the more that they become acquainted with them, and I have no doubt whatever that, little by little, the Brie, if made here in perfection, would extend and become an important article of dairy produce. How important it is in France few people are aware. By reason of the great demand for the best quality and the price that it returns for the milk, it has much to do with the general prosperity of the French dairy farmer. Generally speaking, while a pound of English cheese is made from a gallon of Jersey milk, a pound of French soft cheese requires only half a gallon, and yet the soft cheese returns almost as much, and frequently more money per pound. In five arrondissements in the Brie district alone, six million Brie cheeses are annually made. Estimating these at an average of four pounds weight each, they represent the yield of 25,500 cows, supposing the return per cow to be 450 gallons, To estimate this important fact at its full value, it should be understood that there are 19 English counties in which, according to the Agricultural Returns, cows and heifers, in-milk and in-calf, do not reach this number. The probability is therefore that there are very few counties in this country in which so many cows actually in-milk are kept, and if the Brie system were flourishing among us to the extent that it flourishes in France, it would practically prove the staple industry of the farmers of an entire and leading county. Although the Brie is a high-class cheese, it can be made of either new or skim-milk, or of a mixture of both; but cheeses of the higher class, while being made of new milk of rich quality, must be made of the milk from one milking—the mixing of the morning and evening milk being detrimental. The object of the maker is twofold. Firstly, to obtain a *pâte* which, when fully ripe, or *affiné*, re-

sembles thick cream, a portion of which immediately oozes from beneath the crust where the knife has been inserted. Secondly, to obtain a mild, yet rich aromatic flavour, which no cheese possesses in the same degree as the Brie. To obtain these two features, in addition to ordinary care good cattle and good management are necessary, the feeding must be appropriate, and the dairy suitable, *i.e.*, it must be one in which the peculiar fungus of the Brie not only exists, but grows in full vigour. This one important point explains why many of the first experts even in France are always unable to produce cheese of the highest type, whereas others who work almost by rule of thumb are able to turn out cheese of the very highest quality. I have repeatedly enquired of French makers if it be true that it is necessary, in starting a new dairy for cheese-making, to import the fungus from an old dairy in which it exists. This fact was told me some years ago, I believe, by the late M. Cyrille Paynel, of Camembert fame, and in one instance he had found it necessary to wash the walls of a new cheese room with a liquid which was really the washings of an old cheese-ripening apartment. The idea is now, however, disputed by the French makers whom I have asked, but the fact remains that such an importation is not only sometimes made, but absolutely necessary. M. Siot Decauville, who kindly gave me an introduction to Madame Decauville's dairy, has related how he was unable to obtain a particular variety of fungus which is responsible for the conversion of the Brie curd into the highest class of cheese. He sought it in various humid cellars, and subsequently found it and sowed it upon his cheese with success.*

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* He says in his little brochure upon the Brie :—

Il est reconnu qu'on peut semer le champignon sur le fromage; pour mon compte personnel, je m'en suis convaincu encore tout dernièrement, et voici comment. On connaît les belles taches rouges qui viennent par hasard sur quelques fromages comme un cachet et qui sont fort recherchées : elles sont, pour beaucoup de personnes, accidentelles et dues à l'endroit seul où sont conservés les fromages.

Je connais même quelques fermiers qui l'obtiennent presque toujours, ils sont privilégiés ; aussi je cherchai longtemps dans certaines caves humides, voulant à tout prix trouver le champignon similaire à celui-là, tout au moins en apparence, et je finis enfin par le découvrir.

Dans une cave humide où l'on avait laissé des tonneaux vides, j'aperçus sur l'un d'eux et à la place de plusieurs fossets où le fût avait pleuré deux végétations superbes d'un rouge vif au milieu, et entourées d'une belle moisissure blanche exactement comme ce que je désirais trouver. Je m'empressai de les recueillir, puis de les mettre sur un fromage qui était à sa première végétation extérieure ; au bout de quelques jours, le champignon s'était étendu et teintait agréablement le fromage.

Ce n'était pas la première fois que je greffais un champignon d'une autre couleur, mais cette opération me fit d'autant plus de plaisir, que j'avais sous la main ce que j'avais cherché si loin et que je désespérais de trouver.

The following is a translation of the above :—

"It is understood that fungi can be cultivated upon cheese; for my part I

In confirmation of this fact I have myself succeeded in making a high-class Camembert, only by the introduction of the fungus peculiar to it from an important French dairy in France. Careful observations and experiments prove to any one acquainted with curd-manipulation or cheese-making that different varieties of fungi appear under different conditions. For example, a cheese left to ripen at a low temperature will be covered in the course of a few weeks with a very small, insignificant, grey fungus, not unlike that which forms upon the crust of a pressed cheese. If the new cheeses are exposed to a humid atmosphere, they will be covered with a common white mould, tipped with black points, and these in a short space of time will bring about a bitter taste in the cheese, just as the first-named fungus will convert a curd into cheese analogous to that of a pressed cheese. Again, it is possible to obtain a Brie entirely covered with a red fungus, by using an extremely small quantity of salt instead of the full allowance, and by regularly placing the cheese upon mats which have been previously used, and which are consequently tainted with acidity from having been soaked in whey. This red fungus is appreciated by a certain class of buyers, inasmuch as it is responsible for the flavour which, although less delicate and refined, is appreciated by a certain class of consumers. The highest class of fungus is a bright blue, and this does not appear upon the cheese until it has been completely covered with a perfectly white, even, and somewhat heavy mould. At the end of six or seven days the blue fungus appears in spots or *boutons*, and gradually extends over the whole surface. Lastly, between fifteen and twenty days, under ordinary conditions of temperature, this bright blue mould is in its turn covered with a second, but smaller white fungus. The decomposition of the first mould gives the cheese the peculiar reddish hue which is seen beneath the last mould. By this time, however, continual handling in the process of turning has flattened or destroyed much of the fungus, so that

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am quite convinced of the fact, and in this way. We know that a fine red vegetation sometimes comes by chance upon some cheeses, and gives them a stamp of value—a most *recherchée* quality. This vegetation is quite accidental and entirely owing to the apartment in which the cheeses are preserved. I know some farmers who are invariably able to obtain it—they are privileged. To obtain this fungus I searched for a long time in humid cellars, and determined at any cost to find it; and at last I succeeded.

"In a damp cellar, in which were some empty barrels, I found upon one of them a superb fungus, a bright red in the centre and surrounded with the fine white mould exactly as I desired. I took it, put it upon a cheese which was undergoing its first vegetation, and at the end of some days it had spread and agreeably tinted the cheese. This was not the first time that I had grafted a fungus of another colour; but the operation in question gave me much more pleasure, inasmuch as I had searched so long that I despaired of success."

the yellow crust of the cheese is more extensively seen. The cheese-making public are often unable to understand why a soft cheese which contains so large a quantity of whey does not become sour and decomposed, and statements have been continually made, without any warrant whatever, that soft cheeses will not keep, whereas it is well known by those who make and sell them that they will keep quite as well as cheese of any other description. According to M. Duclaux, whose experiments in this direction are well worthy of study, the various fungi are responsible for the generation of carbonate of ammonia, which neutralizes the acid which forms in the cheese from the sugar it contains, and this same fungus, probably acting in a similar manner to the rennet organisms, which by a process of digestion convert raw curd into cheese, transforms the soft unpressed curd of the Brie and its kindred varieties into an unctuous creamy substance, which is so opposite in consistence to the new curd from which it is made, and which it is the chief aim of the French maker to produce. A Brie of high quality is at its best in about six weeks; but if made from skim-milk it may be eaten at ten days as new cheese, the fuller flavour of the ripened or *façon* Brie being, as is the case with most skim-milk cheeses when refined, somewhat too strong for most consumers.

With regard to the feeding of the cattle for French cheese-making, I have observed that the use of grains causes a fermentation in the curd which entirely spoils the character of the cheese, and French makers themselves are exceedingly shy not only of grains, but of distillery refuse and fermented foods of all kinds. What says M. Decauville? "What is that which spoils the flavour of our cheeses? It is the pulp which is thrown upon us by the sugar refineries existing in such numbers in our country. The farmer grows his beet; he sells it to the sugar-maker, and instead of giving it to his sheep, it reaches his cows in the form of refuse or pulp, and what does he obtain?—a Brie of detestable flavour. *In theory, it is necessary to avoid all fermented foods in order to succeed in making good cheese.*" The foods most used by the Brie farmers are lucerne—both green and in the form of hay—peas, carrots, potatoes and bran, most of which form the principal items in the winter ration; but barley-meal, although not recognized as a cow-food in England, is especially obnoxious to the French cheese-maker. There are many things to avoid in making Brie, and a maker should rather depend upon his knowledge of the work, which must be based upon the actual principles of manufacture rather than upon rule of thumb. The curd may be set at from 82 to 86 degrees in the case of new milk, and 77 degrees in the case of skim-milk; but

while the former should be a quick curd, coming in 4 hours, the latter should be a slow curd, taking 18 to 24 hours. A quick curd will cause a hard cheese, which is objectionable, and this may also be brought about by allowing the curd to remain too long before it is put into the moulds. Practice alone can dictate when this work should take place. If too young, the fat of the curd will drain off in the whey and spoil the quality ; if too old, *i.e.*, too firm and too elastic, the *pâte* will not be unctuous. Drainage of the whey will not be sufficiently perfect below 56 degrees Fahr., consequently the dairy must be heated in cold weather; but the French prefer animal heat to stoves or pipes, and connect their cheese-rooms with their cow-houses in order to obtain it, objectionable as it may seem. Let us fully understand the principles of obtaining curd in cheese-making. We have to consider the quality and volume of the milk, the temperature of the milk and of the atmosphere, the strength of the rennet, and the time in which it is necessary to bring the curd. First, as to temperature. Curd is obtained more rapidly in warm than in cold weather, hence the necessity of employing a larger quantity of rennet in one season than in another. Skim-milk requires less rennet to coagulate it in a given time than whole-milk, and thus it will be seen that the richer the milk the greater the quantity of rennet required ; so that the same number of cubic centimètres employed in forming a curd in four hours from Shorthorn milk would not prove satisfactory in the case of Jersey milk. The time employed in the coagulation of milk is in an inverse ratio to the quantity of rennet used. Thus the more rennet employed, the shorter the time taken in the formation of the curd. Again, the same fact holds good with regard to temperature—for the temperature of the milk is in an inverse ratio to the quantity of rennet employed. Thus, if it is required to bring a Brie cheese-curd in four hours, it would be necessary to use less rennet at a temperature of 85 than at a temperature of 80 degrees. In making a soft cheese we desire a tender curd, which can be converted into an unctuous cheese. To obtain this a small quantity of rennet is necessary, and, ordinarily, a low temperature. These are two cardinal points in soft-cheese making, therefore it is an axiom that a large quantity of rennet not only spoils the cheese by bringing the curd too quickly, but by causing a loss of quality through the drainage of the fat-globules with the whey. The opposite error, however, must not be fallen into ; for if the curd is too tender, the whey will be found difficult to drain.

Some details with regard to the employment of rennet in dairy science will probably be found useful. Calculations are generally formulated upon the basis of a rennet of a strength of

1 in 10,000, *i.e.*, which is sufficiently strong to coagulate ten thousand times its bulk in liquid of ordinary milk at 95 degrees in 40 minutes. On the Continent this formula is more easily understood by reason of the decimal system, the cubic centimètre being a ten-thousandth part of ten litres.

Upon the basis of these figures my friend, Dr. Jacopo Rava, of the Reale Stazione Experimentale at Lodi, in Italy, has constructed an algebraical formula which gives the golden number of 40,000 as a key to ascertain the strength of a rennet, the quantity of milk which can be coagulated, the quantity of rennet which must be used, and the time it will be employed under certain given conditions. These formulæ I have carefully worked out and amplified, and I believe they will be found to be of considerable service in the cheese-making industry. First, in order to find the strength of a given sample of rennet, the number of litres of milk to be used (a gallon is $4\frac{1}{2}$ litres) must be multiplied by 40,000, and the result divided by the number of cubic centimètres of rennet, and the minutes occupied in coagulation. Thus, supposing 48 gallons (216 litres) of milk is coagulated in 60 minutes by the use of 18 cubic centimètres of rennet, we can ascertain the strength of this rennet as follows:

$$(40{,}000 \times 216) \div (18 \times 60) = 8000.$$

In order to ascertain how much milk can be converted into curd with a given quantity of rennet of a known quantity, and in a fixed time, it is necessary to multiply together the quantity of rennet by the time to be occupied in coagulation, and by the strength of the rennet, and afterwards to divide the sum obtained by 40,000. Let us suppose that we wish to ascertain how much milk can be coagulated in 60 minutes, with 18 centimètres of rennet of a strength of 8000. This is the actual strength shown by Mr. F. J. Lloyd of the rennet of Messrs. Fullwood and Bland in the Dairy Show competition. We get the following formula:

$$(18 \times 60 \times 8000) \div 40{,}000 = 216 \text{ litres, or } 48 \text{ gallons.}$$

When it is necessary to ascertain the quantity of rennet necessary for a given quantity of milk, the number 40,000 is multiplied by the number of litres of milk, and the result divided by the sum obtained by multiplying the number of minutes the curd is setting and the strength of the rennet. Thus:

$$(40{,}000 \times 216) \div (60 \times 8000) = 18 \text{ cubic centimètres.}$$

To find the time which would be employed in coagulating a given quantity of milk, with a given quantity of rennet of known strength, it is necessary to multiply the number of litres

of milk ($4\frac{1}{2}$ to the gallon) by 40,000, and to divide the result by the strength of the rennet multiplied by the number of centimètres. Thus:

$$(216 \times 40{,}000) \div (8000 \times 18) = 60 \text{ minutes.}$$

It must not be forgotten that in every case the temperature of the milk is alike—95° Fah., but there is no greater difficulty in constructing similar formulæ suitable to other temperatures now that the principle is shown. As rennet in powder is now being used to a considerable extent, more especially as it took the first prize in the Dairy Show competition, it is necessary to apply a formula to it. This is simple. A gram must be accurately weighed and dissolved in 100 times its weight, or 100 per cent. Each cubic centimètre of the solution must be multiplied by 10, to give the equivalent starting-point of the liquid rennet. Thus, taking the first-prize powder of Dr. Moritz Blumenthal of a strength of 78,780, which for simplicity's sake may be called 80,000, we have a rennet ten times as strong as that named above. The formula will therefore be as follows:

$$(40{,}000 \times 216) \div (80{,}000 \times 60) = 1{\cdot}8 \text{ cubic centimètres.}$$

This multiplied by 10 = 18 cubic centimètres, the quantity necessary to use under the same circumstances as in the above case.

In making a large Cheddar cheese, a difference in the quantity of rennet added to the extent of a few drops makes no difference either way, especially if the rennet is weak; but in the case of soft cheeses, made always in small quantities at a time, the slightest variation is of great importance, hence the necessity of using a rennet which is largely diluted with water. I have experimented with two varieties only to any extent, those of Hansen and of Fullwood, and I find it necessary to add water to each, and even then to add the rennet drop by drop to the milk, stirring all the while. A soft-cheese maker must be careful to ascertain by experiment upon his milk how much rennet to add, both in warm and cold weather, and then with the same milk, the same rennet, and the same addition of water he will not fail. Care, however, must be taken that the rennet is well preserved by corking and keeping in a cool dark place, as it loses its power very rapidly under other conditions. Another difficulty in soft-cheese making is the rising of the cream. To prevent this, the maker must follow the example of the Cheddar makers, who stir their milk for half an hour after the addition of the rennet. Practice will show when the milk commences to coagulate, and it may be occasionally stirred to prevent the rising of the cream until that time when all danger is passed. Cheeses made from curd, with a layer of cream at the top, have veins which are unsightly, and they are defective in quality.

The quantity of milk used in a Brie varies from one to two gallons. I have used 10 and $12\frac{1}{2}$ lbs. respectively from Jersey and Shorthorn milks, the Jersey cheese being preferable, and quite as large as the Shorthorn. These cheeses are retailed by the London dealer, to whom they are sent, at 1*s.* 6*d.* Details with regard to the moulds and other utensils used, together with the full process of manufacture, are given in "British Dairy Farming," and in the 'Journal of the Bath and West of England Society.'* There is one process in the work of Brie-making which resembles that of Stilton. The curd is removed into the moulds in slices or layers, unbroken, if possible, the whey finding its way out by means of the divisions between each slice, and the less the slices are broken, the more homogeneous is the cheese. Sometimes, especially in warm weather, the curd falls abroad. In this case, the mould known as the "éclisse" is used. This opens at the sides, and by lessening the diameter the curd is brought together, and rendered sufficiently compact. Among other points which deserve to be remembered are the following. The walls of the cheese apartment should be of plaster instead of cement, for it is found that the fungus is not retained in its vitality in the one case as in the other. Windows must be fitted with wire gauze, to prevent the ingress of flies, which are alone responsible for the worms which attack the cheese in hot weather. The cheese room must be provided with a number of windows to enable the air to play upon the rows of cheese according to the direction of the wind, or sun, and the windows must have shutters, to entirely exclude the air when the atmosphere is damp. In a word, successful ripening depends upon plenty of dry air at a moderate temperature, *i.e.*, not exceeding 60 to 65 degrees; a recognition of the facts named above will explain why the cheese rooms of so many French makers are constantly found dirty and stuffy, for they are shut up in damp weather, and have at all times exceedingly dirty walls—the entire apartments reeking with fungoid growth.

Gorgonzola.

At this moment the Gorgonzola cheese of Italy is one of the most popular cheeses in this country, its sale increasing to an enormous extent, while at the same time its price is decreasing. There is perhaps no cheese about which so little is known, and in my own investigations I have found it impossible to obtain any reliable information whatever, either in England or in France. With a view, therefore, of learning something of the

* 'Journal of the Bath and West of England Society,' 1885–6, vol. xvii.

system of manufacture it has been necessary for me to make two visits to Italy, with the result not only of learning something about the cheeses of that country, but of forming an agreeable acquaintance with some of the first authorities upon Italian dairy farming. To these gentlemen I owe much of the information which is contained in the following lines. Details of the system of making Gorgonzola have been written by Dr. Giacomo Maffei, to whom many thanks are due for his personal assistance and instruction in the mysteries of the manufacture of Parmesan, and by Dr. Luigi Manetti, director of the Royal Dairy Station; but these details differ as much as the systems which are adopted by different manufacturers. Indeed it is somewhat difficult to lay down any fixed rules for making the cheese, inasmuch as there are two classes of persons who are engaged in the work, and who are controlled by entirely different circumstances. In the one case there are the cowherds, without homes, who originated the Gorgonzola, and who after preparing the curd, sell it for conversion into cheese; while on the other hand there are the ordinary farmers, or milk-buyers, who conduct the entire operation for themselves. Gorgonzola cheese takes its name from a small town, near which the cowherds are accustomed to rest on their passage to and from the Alps with their cattle. It is the centre of a small district in which the pasture is unusually rich; hence they take advantage of it, more especially on their way to the towns of Lombardy in October, finding as they do a comparatively rich feeding ground for their cattle after the pasturage upon the Alps has been exhausted. Originally the milk produced during the rests made here and at other places by these cowherds was literally sacrificed, for as they live for the most part of the year without fixed homes, they have no means of making either butter or cheese for themselves. At last, however, they hit upon the plan of converting their milk into curd, and selling it in its raw state to persons in the district of Gorgonzola, who made it into a refined cheese. Since, however, this cheese has been perfected and become known in other countries, it has been manufactured by persons of a different class in other parts of the north of Italy, although I believe it is made nowhere in such perfection as in the district which gives it its name. My friend Dr. Maffei, of Reggio, Emilia, says in one of his articles that the English have awarded a royal crown to this product of Lombardy, which, by-the-bye, is commonly called *Stracchino*, the word being derived from *stracco*, the Italian for the French word *las*, signifying that the cheese is made from tired cows on their way home from the Alps. The manufacture of Gorgonzola cheese demands several important considerations: considerable skill, prolonged atten-

tion for the salting and refinement, lasting some months; special apartments, and a milk which is not too rich in fat, for it sometimes happens that when the milk contains too large a quantity of butter it is necessary to cut the curd into fine particles, in order that some portion of it may drain away in the serum. When the cheese is made in the Gorgonzola district from curd supplied by the cowherds, called *Bergamini*—the term being derived from the province of Bergamo—the cows are milked in the open air, being tied to stakes or stones fixed in the ground, as is the case upon the pastures in Holland. While the milk is still warm, at 95 to 97 degrees, the rennet is added. This rennet is in the form of paste, and is similar to that commonly used in the cheese industry throughout Italy. It is composed principally of the stomach of the calf chopped fine, and has a most disgusting smell. A small lump, at which the cowherd guesses, is placed within the corner of a cloth and dipped in the milk. The rennet is then continually squeezed by the hand in the milk, until only a few particles of fibrous matter remain. The milk is then well stirred, and the curd is brought in a very short space of time, especially if the weather is at all cold. Where the cheese is made in a well-constructed dairy or factory, this term being generally applied to Italian farms, the milk is set at a much lower temperature, from 80 to 85 degrees, but the curd is brought equally quick. When it is fit for manipulation it is very gently broken up by a wooden utensil, called *paumarilo*. This breaking up is a very delicate affair, lasting some fifteen minutes. The green whey is then seen to appear at the surface, and wherever the utensil has been. Pails made of wood are lined with strong hempen cloths about a yard square, the four corners lapping over their sides. The curd is then very carefully poured into the pails, the ends drawn together, and the curd suspended upon a stick or rod. In the case of the curd from the evening's milk it is allowed to remain all night, indeed until some little time after the morning's milking, the temperature in the apartment in which it hangs being in some instances 60, and in others 65 degrees; but where the curd is prepared by travelling cowherds it is often found to be as low as 55 degrees by the morning. In all cases a vessel is placed beneath each lot of curd, in order to catch the whey, which is generally set for butter-making. The curd of the morning, which is treated in the same manner as the curd of the evening, is only suspended for a very short time, and in some instances it is not suspended at all, being left in the pail for a quarter of an hour, during which time a large quantity of the whey is removed. It is considered very important by the bes makers that the *locale*, or room in which the curd hangs

should not be too warm, otherwise too much lactic acid is developed, which ultimately spoils the peculiar flavour of the cheese. The climate of Italy practically prevents cheese-making except in the two spring months, and for the same reason in two months during autumn, although there are now some large factors, one or two of whom I have visited, who have constructed an elaborate system of cellarage, which enables them to store and ripen the *stracchino* during almost any month of the year. Just as excessive warmth is deleterious to the curd, so is excessive cold, by reason of its preventing a proper drainage of the serum, for unless the operation of manufacture is conducted sufficiently near to the regulation time, there is little hope of the cheese being of high quality. When the curd of the morning is ready for removal, it is placed, together with the curd of the evening, upon an inclined wooden table, in which are a number of small fluted grooves to assist in carrying off the whey. Some rye-straw is then laid across the grooves, and the cheese-mould placed upon it. The Gorgonzola-mould is of wood, preferably beech. It is of course round, but open at the sides, and can be made larger or smaller in diameter at will. A cord is attached to one end, so that in lessening the diameter the mould can be fastened. In some cases two moulds are used, one being fixed upon the top of the other. In this case the uppermost mould is removed, when the curd has sunk within the lower mould, but in the ordinary way a single mould of 27 to 30 centimètres, or 11 to 12 inches, high is used. When ready for filling, the mould is lined with a similar cloth to that which has been placed in the pails, and then with a flat broad spoon or slice, in which are a number of holes, the curd is placed within the moulds in Stilton fashion, layer by layer, every slice being extremely thin, certainly not more than half an inch in thickness. There is, however, this difference in the Gorgonzola system, that the curd of the morning is placed at the bottom, at the sides, and at the top; the rest of the cheese being composed of alternate layers of morning and evening curd. It is between these layers that the fungus or green mould commences its growth, although there are instances in which makers encourage it by the introduction of moulded bread-crumbs, in imitation of the makers of the Roquefort cheese in France. Where a single mould is used, the maker places the curd as high as he possibly can, and then covers it with the ends of the cloth, which are very carefully folded; this operation being performed with the same exquisite neatness that characterizes the work of the Edam cheese-makers in Holland, whom I have always admired for their skill in preventing cloth-marks upon their round cheeses. Where a second mould

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is used, it can generally be removed in six to seven hours, the whey draining off, and the curd sinking with great rapidity. The apartment in which the curd, when in the mould, is placed is maintained at from 66° to 68° Fah., this temperature being necessary to facilitate the drainage in the requisite time. In some instances, *i.e.*, where a single mould is used, the cheese is turned in four hours; in others it is not turned for twelve hours. In the first instance it is turned twice during the first day, the second turning being in the evening. In both cases it is taken out of the moulds on the following morning, and the cloth removed, the cheese being put back into the mould without it. Where curd is prepared for sale by the cowherds, this is the period at which it is weighed to enable them to obtain payment. As it commonly happens that the shape of the cheese, as well as its size in comparison with the mould, is affected by the removal of the cloth, the cord is now unloosened, and the diameter lessened to correspond with that of the cheese, when the cord is again fastened. It is now removed to the salting-room, which is maintained at 68 degrees. Here it is turned daily for three or four days, when the mould is finally taken off. At this time a minute white fungus shows itself upon the surface of the cheese. This is the moment to commence the salting process. Inferior makers are apt to salt heavily at first; but this has been found a most objectionable practice, as it assists in the formation of a hard crust, which prevents the salt afterwards so freely used properly penetrating into the body of the cheese. In some instances, too, makers strew a quantity of fine salt upon the table, and roll the cheese upon it; but the best makers carefully sprinkle a very small quantity of salt upon the sides and upper surface, rubbing it in gently with their hands, while at night they sprinkle the lower surface in the same manner. The apartment in which this operation takes place is appropriately termed the salting-room, for the cheese is salted daily for an entire month, each side getting in all from fifteen to eighteen saltings. During the latter portion of the time the cheese is wiped with a cloth which has been dipped in brine, every care being taken to introduce salt into the cheese by degrees, for where powdered salt is used, it is always well rubbed in with the palm of the hand. During the last salting the maker ascertains if the cheese is too compact for the proper growth of the fungus, and if so, he pierces it with a long needle in various places to encourage the growth by the introduction of the air. When the salting process has been completed, the cheese is removed to the curing cellar, which must be somewhat humid but airy, care being taken to place the cheese in a direct current which passes from window to

window, situated at opposite ends of the apartment. The sun, like the frost, is rigidly excluded. It is hardly possible to convey an impression of the perfection of the Italian Gorgonzola cellar, especially of those belonging to the large factors. Signor Pessina, one of the principal factors and curers near Milan, very kindly showed and explained to me the details of the extraordinary building which he has erected for ripening Gorgonzola and Parmesan at all seasons of the year. He has the temperature, as well as the light and air, entirely under control, and upon one of the hottest days in summer I found that his cellar, large as it is, was maintained at 55 degrees. The cheeses are placed upon shelves upon rye-straw, some 6 to 8 inches apart, to give them plenty of air. They can be ripened rapidly, or the ripening process can be delayed by a change of temperature, and a factor provided with proper cellarage, and able to control his temperature, stands in a most favourable position, being almost able to supply the market at will. In the ordinary way the cheese takes from four to five months to cure, but it may take twelve months, and then be absolutely perfect, or if necessary, it can be ripened in half the time by the assistance of holes bored in the sides. As the cheese commences to ripen, it is first covered with a fine fungus of a dark colour. This is then covered with a white fungoid growth, and subsequently with a red, and the more perfect the last is, the better is the cheese estimated. Makers generally attempt to imitate the red fungus by colouring the surface of their cheeses with brick-dust. They subsequently roll them in flour, giving the cheese the appearance of having been covered with a red fungus, which has been subsequently crushed by handling. I was remarkably struck with the fact that, although the Gorgonzola cheeses eaten in England are firm in texture, they are in Italy extremely soft, the *pâte*, or flesh of the cheese, more closely resembling the ordinary cream-cheese. I was informed that the English prefer a cheese of this kind; but it can only be the assumption of the Italian factors, who are guided by the kinds of cheese we make in England, for there is no comparison between the well-made soft Gorgonzola, such as can be found only in the real cheese-making district, and the cheese which is commonly found in England, admirable as that may be. Another point of importance worthy of observation is the undoubted fact that the conversion of the raw curd into the peculiar agreeable *pâte*, to which reference has been made, is entirely owing to the fungus by which it is surrounded. If an expert, or any person of ordinary intelligence, will make a series of observations upon some cheeses of this make at different periods of their ripening, he will perceive beyond doubt that the perfection of the *pâte* is just in proportion

to the perfection of the growth of the parasite, and that where the flesh of the cheese is to any extent free from the fungus, the parts most distant from it are not converted into perfect cheese until they have been reached by the influence of the fungus. A large percentage of Gorgonzolas are spoiled by over-ripening, chiefly due to apartments of too high a temperture. In many other cases the curd becomes too yellow as it is converted into cheese, and this happens long before the green mould has appeared. These cheeses are imperfect, and are sold at greatly reduced prices. Signor Pessina has introduced a white Gorgonzola to suit a class of Italian customers, who, as he explained to me, object to eat the real article on account of the frequent introduction of drugs which are used for giving an imitation of the green mould. I tasted several of these cheeses, which had nothing specially tempting about them. They are ripened in an apartment where fresh air is excluded as much as possible, and where the air is dry. Instead of an aromatic flavour and salvy *pâte*, they are quite sweet and somewhat waxy. In the ordinary way, 10 gallons of milk make from 13 lbs. to 15 lbs. of cheese, according to the stage at which it is sold ; but now that it can be purchased in England at a price which is greatly reduced, the industry is not so profitable to the Italians as formerly. At the same time it is sufficiently profitable to make it well worth the while of English dairy-farmers, who would reap a decidedly better price per cwt. than for either Cheshire, Cheddar, or any other leading variety of hard cheese. The apartments necessary in a first-rate Gorgonzola factory are the milk-setting-room, the salting-room, the first ripening-room, and the cellar. In some cases, however, the second and third apartments are combined. I may quote one instance which will fully exemplify the great trouble which is taken by large numbers of *stracchino*-makers to produce a perfect article. When last in Italy, I received an invitation from Signor Antonio Zazzera, of Codogno, to visit his factory, which is very important from the point of view of butter as well as of cheese. This gentleman manufactures his Gorgonzolas at Codogno, but he refines them nearly 100 miles away on the banks of the Lake of Como, where he has constructed his caves on the side of a mountain, introducing air-holes which are in direct communication with a distant cascade, by means of which he is enabled to pass a cold humid air directly across his cheeses. The raw curd cheese is sent daily from the factory, and Signor Zazzera is perfectly independent of the heat of summer, the cheese taking the mould with great rapidity. The following analyses show the composition of Gorgonzola, the second analysis being by Soxhlet:—

Water.	Fat.	Casein.	Salt.
36·°2	33·69	25·67	3·71
43·56	27·05	24·17	4·32

Skim-milk Cheese.

The introduction of a soft cheese made of skimmed milk into the market has given rise both to speculation and criticism, and yet there can be no question that it is a step which will be followed by success where it is well made and well marketed. It has been declared than an edible cheese cannot be made of skim-milk, that people will not be induced to buy it, and that it must be eaten immediately on account of its perishable nature. The last remark may be instantly dismissed, as it is entirely opposed to the truth, for a soft skim-milk cheese is not really edible until it is at least from seven to ten days old, according to the season; and its ripeness, partially due to fermentation, can be retarded at will. In any case, when subjected to the same temperature to which cheeses of other kinds are subjected, it only ripens into a cheese with a strong flavour, which, although admired in some parts of the Continent, is not, it will be admitted, likely to find much favour in this country. As a matter of fact, there is nothing particularly new either in the manufacture or the sale of a skim-milk soft cheese, inasmuch as the York cheeses and the Huntingdon cheeses, as well as many others made in the Midland Counties, are practically produced from skim-milk, but they are unskilfully made and neither keep nor mature so well. A well-made cheese when at its best requires the palate and judgment of an expert to discover that it is not made from whole-milk, more especially if it is made from Jersey cattle. The system adopted enables the maker to produce a tender curd instead of one which is tough or waxy in consistence. This curd is easily made by any person having a complete knowledge of the manipulation of milk. It is not necessary to publish a detailed formula for making the skim-milk cheese, known as the Graveley, (inasmuch as it has appeared elsewhere,)* as in the case of the Brie, but it may be remarked that the milk is set at a very low temperature, and a small quantity of rennet is used, for it is both temperature and excess of rennet which give toughness to a curd, especially when it is deprived of fat.

* 'Journal of the Bath and West of England Society,' vol. xvii., 1885–6.

It is necessary to draw a distinction between skimmed milk and separated milk. The skim-milk obtained from the shallow-pan system of setting for cream, contains just sufficient fat to make all the difference in the quality of the curd as well as in the size of the cheese, but a cheese made from separated milk is not only more diminutive in size, but much inferior in quality, and would certainly not be so saleable. I have found that consumers prefer to eat a soft cheese of this description at the time when the first or white fungus has gently spread over its surface. It is then not only sweet, but clean and delicate to the palate, and the *pâte* is extremely unctuous. Compared with the local English cheeses named above, it is decidedly superior to either as they are purchased in the London market, and as only 10 to 12 lbs. of milk is required to make a cheese of from 14 to 16 ounces in weight, the dairy-farming public can judge as to the profitable nature of the work. My object is to draw the attention of the public to this useful article of food, which, I believe, will some day become the great factor in solving the problem, *What is to be done with the skim-milk?* The question whether such a cheese is edible, valuable, and saleable, is easily solved by any one who cares to take the trouble to examine for himself and pass his own opinion. The details of manufacture are before the world, the expense is slight, and the risk of failure or loss entirely unworthy of consideration. The man who can make or sell an edible and delicate food of known high nutritive value at from 3*d.* to 4*d.* per pound, is conferring a benefit upon the public at the same time that he is well serving himself.

VI.—*The late Mr. H. M. Jenkins, F.G.S. A Memoir.* By J. CHALMERS MORTON, Editor of the 'Agricultural Gazette.'

ON the death of Sir Brandreth Gibbs, a former President of the Society, the Editor of this 'Journal' told me that I was expected to write the record of his long career—as Member, Volunteer, Director, Organiser, even Secretary for a time, and ultimately President. There was a certain fitness in one who had also been an original member of the Society undertaking the task; and Mr. Jenkins was probably right in suggesting the name of an observer year by year—a critic and reporter in the English agricultural world—during the whole long period of Sir Brandreth's activity in it. But a few months have gone by, and our late Secretary's own life has come abruptly to its untimely close, to the great sorrow of us

all, and once more the task of the biographer has been committed to my hands. There is no such special fitness now. I had opposed his original appointment to the offices which he has held with such signal advantage and ability; and I know that for years he imagined that scant justice was dealt out to him in the weekly journal which I edited. Nor can it be said that the biographer has in this case had that intimacy of association with either the Secretary or the Society he served, which seems to be required. I have had no opportunity of witnessing daily, or from week to week, either the spirit or the method of his official life. His enthusiasm for its duties—his promptitude and system in the discharge of them — his constant eagerness of outlook over the great Agricultural field—his share in the guidance of the Society to one and another of the points in that field on which, as its officer, he has worked:—all these are known to me only by their results. The vigour of the annual volume, and the growth of the annual Show, and the great reputation of the Society both at home and abroad—the outside belief everywhere in its readiness to help, whatever the agricultural need might be: these, which are among the results, are more intimately known by many to whom the record of them might have been more fitly committed. The family, and friends, and the members of the great Society of which our late friend was Secretary may, however, be assured that no one could bring to the duty which has been confided to me a keener sense of the great loss we have all sustained, a more earnest desire to do justice to the example of his career, or a warmer loyalty to his memory.

The following is a bare outline of the story up to the time when Mr. Jenkins joined the Royal Agricultural Society.

Henry Michael Jenkins was born at Fairwater Cottage, Ely Mills, Llandaff, Glamorganshire, on June 30th, 1840. His father, John Jenkins, was one of two brothers, millers and corn merchants, at Organford, near Wareham, Dorsetshire, whose family had formerly been farmers of their own property near Shaftesbury. Having business relations with Mr. L. Michael, flour merchant, of Swansea, John Jenkins in the course of time became acquainted with his family, and ultimately married his eldest daughter. Leaving Organford soon after his marriage, he became the owner of Ely Mills, Llandaff. Henry was the eldest of his children; one daughter is now the only survivor, and there was a posthumous son, the father having died at twenty-seven years of age. Mrs. Jenkins resided at Swansea during the five years succeeding her widowhood, and then married Mr. E. L. Box, a seed and corn merchant of Bristol.

Her sons were educated at Mr. Browning's school, near Bath, where they were known as extremely clever boys, noteworthy especially for extraordinary aptitude and ability in mental arithmetic.* After school, which he left in 1854, Henry Jenkins was engaged for awhile in Mr. Box's office; but this, amid the dusty atmosphere of a corn and seed warehouse, was not the best place for one in whom his lifelong asthmatic trouble had already declared itself; and on medical advice he was sent on a voyage for his health, acting as barter clerk on one of Messrs. Burford and Dyer's ships, trading to the West Coast of Africa. The duties of this office were discharged by him with perfect satisfaction to his employers; and, returning with improved health, he obtained a situation in the office of Messrs. T. and A. Warren, manufacturing chemists, of Bristol. Here at length he entered on the work of self-education in chemistry and other branches of science in which his occupation was concerned; and, an eager student from this time of various branches of natural history, he was happily ready for the next step, for which the opportunity soon arose. Professor T. Rupert Jones, who was then Assistant Secretary of the Geological Society in Somerset House, tells me that a clerk in the adjacent Government office, a cousin of Henry Jenkins, had brought him fossils which had been unearthed during the drainage works in his neighbourhood at Peckham; and, through the acquaintance thus casually established, he had acquired the earliest intelligence of a situation in the rooms of the Geological Society as assistant in the library and museum; and young Jenkins gladly jumped at the opportunity which thus arose of a removal to London.

His employment on the staff of the Geological Society was a new beginning of his life; he there came under training at once strict, appreciative, and kind; his duties under this supervision had to be systematically, punctually, and perfectly discharged. New duties grew up for him as his quality and capability were realized, and ample opportunity was given him for further scientific education. Professor Rupert Jones, his chief, who soon became his friend, tells me that during this period he was a laborious student in the adjoining King's College class rooms, and at the Royal School of Mines in Jermyn Street —permitted for that purpose to use time during college hours,

* Mr. Browning gives me the following note:—H. M. Jenkins entered this school when he was about ten years of age, and remained until he was about fifteen. He was a very quick boy, and his promotion in the school was rapid. As an arithmetician he was unequalled. His great *forte* was mental calculation. He required neither pen nor pencil for answering abstruse questions, and it is a tradition here that, if you gave him a dozen columns in compound addition, he would give the answer almost directly.

which he had to make up by later evening work on his immediate duties to the Society. Here his knowledge of chemistry and, of course, geology, grew rapidly and matured. Here, too, and at the Gardens in Regent's Park, his botanical studies were eagerly and successfully prosecuted. His remarkable literary powers also grew under his present training. His note-books, always clearly written, without blot or erasure, were the tersest and yet the completest reproduction of the lectures he attended. The only one which I have seen is a marvel of good student work; and I have been informed that one of the professors years afterwards applied for Jenkins's notes, and used them as the basis of a repeated course of lectures, for which his own memoranda were missing. This, coupled with other literary work in which his assistance was first permitted and ultimately welcomed, was admirable training for his future. The 'Journal of the Geological Society,' edited by the Secretary, came under his eye in unread proofs from the printer; and, reading them, pencil in hand, he frequently took the liberty of marginal corrections not only of printers' errors, but, at length, almost unconsciously, of style. "This is not your handwriting," said the author of a paper, bringing it to the Secretary and pointing out the alterations of an involved sentence, of which he saw a pencilled suggestion on the margin of the page. "Not mine; it is by a clerk on duty here," was the reply. Jenkins was called at his request. "I understand this is your writing, young man," was his greeting; "well, just rub it all out, will you"! But the volunteer corrector of the press had the pleasure, nevertheless, of observing afterwards in print that the correction in question had been adopted. And at length the Secretary could trust his young assistant to take a share in the authorship of comment, preface, introduction, or translation—whatever the editorial duty might be. Nor was Professor Rupert Jones the only friend by whom the young assistant in the rooms of the Geological Society was thus stimulated and advised. He had friendly touch of many of the distinguished men who frequently assembled there. Mr. Leonard Horner, among others, pushed him along with his inquiries and advice, urging him, among other things, to master foreign tongues — German, French, Italian — if he desired to step out of the mere drudgery of office life. All this time, however, let it be remembered, not only had he to struggle with very limited means, but the old ill-health remained an added difficulty. "Many a time," says his friend, "have I seen this slight young man stop more than once to recover breath, as he went upstairs to his rooms." The modest pay of his position, barely enough for self-maintenance, was at length eked out by literary work in various

popular scientific journals, which welcomed a correspondent from the rooms of the Geological Society; and thus he was enabled to bear the various expenses—fees for lectures, teachers, classes, books—in which his student life involved him. All this while his geological studies were advancing. His mastery of the museum in which his duties chiefly lay was itself a full geological education; and when Mr. Rupert Jones became Professor of Geology at Sandhurst, young Jenkins was, to his intense delight, appointed to the office which his chief and friend had held. It must not be omitted here that one great incentive to the urgency of all he did for self-education during this preliminary period lay in the hope and prospect of his marriage. His future wife was one of the charming daughters of Mr. Charlton, who had long been an officer of the Geological Society, and is still on duty at Burlington House. His acquaintance there, soon growing into love, was a perpetual spur to the efforts which so early won their way.

His marriage took place soon after his succession to the office of Assistant Secretary, and he thereafter resided at New Barnet. And from Barnet he daily came to his work at Somerset House, where his duties consisted in the superintendence of the Library and Museum, in the editorship of the Society's 'Journal,' in preparing the agenda for the periodical meetings of the Society and its Council, in preparing abstracts of the English papers to be read, and in translating any foreign memoirs that might reach the Society, whether from France, Germany, or Italy. The correspondence of the Society, too, was to a considerable extent conducted by the Assistant Secretary, who also represented the Society in conferences, or at any meetings affecting its interests. How thoroughly he discharged these duties is attested by those who crowded round him with their credentials when he ultimately sought appointments elsewhere. He applied for the office of Curatorship to the Natural History Museum at Sydney in 1864, and a very striking body of testimony to his fitness for its duties accompanied his application at that time, which was, however, too late. The Presidents and Secretaries of the Society, Sir Roderick Murchison, Professors Huxley, Ramsay, T. Rupert Jones, Martin Duncan, and others, may be quoted among those who declared him competent. I am indebted to Dr. Martin Duncan, F.R.S., since President of the Geological Society, and now Professor of Geology in King's College, for reminiscences of this period. Mr. Jenkins had more than the general geological knowledge which must be possessed by an efficient curator of a geological museum. He had done original work in the geological field, as his several papers at that time in scientific journals and magazines

sufficiently indicate; and in particular he had worked with his friend, Dr. Duncan, on a then new fossil (*Palæocoryne*—from the Carboniferous Limestone)—and a paper giving the results of their research was read before the Royal Society in 1867, and published in the 'Philosophical Transactions.' It has since been the centre of much discussion among palæontologists, who still differ hopelessly on the subject of its classificatory position. "There it is!" exclaimed the doctor—enthusiastic now as ever—pointing to a number of small translucent spikelets in a glass case; "the most beautiful thing the Almighty ever made, and one of the most useful, since it is a standing rebuke of that intellectual pride which imagines all knowledge to be within its grasp." "Nor was the enthusiasm and love of detail which Jenkins then showed," says Dr. Duncan, "without the solid ballast of an unusually sound judgment. One of his friends who consulted him about that time on his own affairs (—engaged in a medical partnership, he had discovered what he believed to be carelessness and inaccuracies in the partnership accounts) has told me that he went to the young Secretary at the rooms of the Geological Society in great anxiety. 'You do well to be anxious,' was the reply; 'you will find that this is not the first blunder which your partner has made. Men who are fifty years of age don't then begin to make mistakes. What they do then is the outcome of habit, and I advise you to look also into previous years if you want to learn the whole truth of the matter,'—which accordingly he did, with great advantage to himself." In addition then to habits, already formed, of systematic industry—thanks to which he had acquired literary ability and scientific knowledge and exact acquaintance with some branches of science—here, it is plain, was an old head on young shoulders. Having also youth and energy on his side, such a man was fit for any office he might desire to undertake.

It is the application, four years later, which he made for the position then advertised as vacant in the offices of the Royal Agricultural Society, that is virtually the commencement of this memoir.

After the death, in 1868, of Mr. Frere, the former Editor of the 'Journal' of the Royal Agricultural Society, the Council resolved that the two offices of Editor and Secretary should be united. An advertisement was accordingly published, and it brought no fewer than forty-six applicants before them. The applications were referred to a Special Committee, each member having all the testimonials to examine at home. When they met in Hanover Square, it was found that a decided majority had fixed upon one out of the forty-six as the man

they wanted. Mr. Jenkins was sent for to be looked at and questioned, and although he admitted his ignorance of agriculture, the Committee unanimously recommended him for election, and he entered on his duties on the 1st of January, 1869. He had already for six years been both Secretary and Editor to the Geological Society, and his application therefore rested on his experience of the equivalent office in one of the largest and oldest of the learned societies established in London; and his very clear statement of the duties which he had already been in the habit of discharging, was really step by step a history of work exactly similar to that which the Royal Agricultural Society of England now wanted him to do. He could indeed, he said, lay no claim to the reputation of an agriculturist or an agricultural writer, but he possessed a general acquaintance with farming operations, and a knowledge of the principles and practice of agricultural economy; and he believed that "a geological and chemical training might be regarded as an appropriate preparation for more extensive agricultural investigation than he had hitherto conducted. His knowledge of zoology and botany would assist him also in suggesting and prosecuting researches on subjects relating to the diseases of crops and domestic animals." I am quoting a sentence or two from the application which he sent in for the office, along with a very remarkable body of testimony to his fitness, from which the following examples may be also reproduced.

Sir Roderick Impey Murchison warmly supported him. "Seeing how intimate is the dependence of the quality of the soil on the nature of the subsoil, I hope," he said, "that the accurate geological knowledge possessed by this gentleman will be considered no slight recommendation. In addition to this, his powers of classification, and his singularly adroit methods in editing the works of others, his accurate habits of business, whether as Librarian or in control of the accounts of any public body, cannot be overpassed."

Professor Huxley spoke of his occupation, since 1862, of the responsible post of Assistant Secretary to the Geological Society: "In that capacity it had been his duty to edit and manage the publication of the Quarterly Journal of the Society, which is an illustrated publication of great scientific importance, varied contents, and of no inconsiderable bulk. Of late years he has also looked into the accounts of the Society, and has been made responsible for the due discharge of the clerks' duties. In discharging these functions Mr. Jenkins had displayed great intelligence, knowledge, and punctuality, and given satisfaction to the officers and fellows of the Society."

Here, therefore, Past Presidents and Secretaries, distinguished

naturalists, and men of science, united their testimony to his possession of the knowledge, capability, and experience which seemed to fit him most remarkably for the position he sought.

The Editor of the 'Journal.'

The first important work on which Mr. Jenkins was engaged was the superintendence of the first part of the 'Journal' of 1869. The material for it had no doubt been already arranged; and beyond the growing appreciation of his duties as Secretary, and the gradual awakening to the possibilities of his position as both Secretary and Editor, his occupation in the outset no doubt seemed to him little but routine—routine, too, of not nearly so engrossing or stimulating a kind as he had been accustomed to. During his first months, in fact, he felt himself to be imperfectly engaged, and he used to return home with the feeling that he had not been fully occupied. His duties, which were originally mainly directed to correspondence, and to the editorship of papers for publication and subsequent correction of the press, culminated once a month in the arrangements for the Council and Committee Meetings held in Hanover Square—in keeping the minutes of all these meetings—and in preparing the usual reports for the weekly agricultural journals. The work of these committees had to be arranged by the Secretary beforehand; and it is well known in Hanover Square how their labours ultimately became lightened by his insight and his information, and I may add by his influence. The conviction of his extraordinary ability in organising and facilitating all such work—ultimately far heavier and more various than it was at first—only gradually became known. But in the outset his powers were tested by directions to investigate and report on the farm management of a number of English districts. This accordingly was done at intervals during 1869, and his reports of several farms in the north and east of England appear in the fifth volume of the second series of the 'Journal,' the first which he edited.

Before I enumerate in succession the several tasks of this kind which he undertook and accomplished, it will, perhaps, be convenient that some more detailed reference should be made to his duties, and his responsibilities, and his general official character as it came ultimately to be known. Let it be understood, then, in the outset, that from the first to the last of all those who were connected with him in Hanover Square, nothing but kindly, appreciative recollection of him exists. The house porter speaks gratefully of the holiday in the country which used

often to be given to him and his family, when Mr. and Mrs. Jenkins on their journeys left their house in his charge. The various clerks and assistants whom he has trained and passed on to more responsible situations, speak of him with gratitude. Mr. H. J. Hine, Secretary of the Shorthorn Society; Mr. J. Sloughgrove, Secretary of the Shire Horse Society; Mr. W. C. Young, Secretary of the British Dairy Farmers' Association, who were trained and helped forward at Hanover Square; and Mr. J. Gale, who has served as head clerk all along, and who represents now, more than any one, the permanent staff there, on whom, as we all know, the traditions and continuity of good management depend;—each and all speak warmly of the regularity, simplicity, and facility of office work under direction of Mr. Jenkins. Systematic, prompt, and punctual, the business moved always without friction. To some of these gentlemen I am indebted for the very strong sense I have acquired of the services rendered by the Secretary to the various committees under which the immense volunteer work of the Society is carried on. It was no mere formal list of agenda that came before them monthly. One by one the several points to be discussed were almost always already on their way to a conclusion. And, whether directly, or by previous correspondence, or by interviews with the Chairman or with individual members, all the information on the subjects in hand, which the indefatigable Secretary had collected, was ready to be considered. An example of efficiency of this kind may be mentioned now, although it belongs to the last year of his life. A Special Committee, presided over by Mr. Wells, were engaged in the consideration of the subject of tobacco-growing. The members, somewhat doubtful of the policy to be considered, were no doubt careful not to be misled by enthusiasts. The Secretary was in attendance; and one who was present tells me that he, there and then, without help from memoranda—recalling his experience among tobacco-growers in Normandy, Belgium, and elsewhere, from memory alone—discussed the whole subject. The possibilities of home growth here, and the risks, successes, failures, methods and results elsewhere, were considered in succession, and illustrated by the examples with which his memory was stored; and at the close Mr. Wells exclaimed, "All we needed was the presence of a shorthand writer, and we should have got just the article for the 'Journal' which we need." The article in question—virtually a reproduction of an impromptu speech—was subsequently prepared and published. And I may say, once for all, that the same powers of memory, the same wealth of information thus illustrated, were similarly available at all other meetings.

It may be proper here to quote the testimony of Mr. Wells, Chairman of the Chemical Committee, illustrative as it is of this subject, and of the impression generally which Mr. Jenkins ultimately produced :—

"I greatly regret," he says, "that I cannot do justice in a short letter to the warm personal regard I had for Mr. Jenkins, or to the admiration I had for his talents and versatile powers of mind. Throughout the many years during which, as Chairman of one of our Committees, I had constant work to do with him as Secretary, I do not remember a single occasion when he was at fault in giving information or advice required of him, or where such information and advice did not turn out to be the best of its kind. His power of grasping new subjects was most remarkable, and I remember as an instance of it, being much impressed, at the time of the action against the Society, tried at Leeds (I think it was), with the rapidity with which he had mastered and could explain in legal phraseology and with the lucidity of a practised lawyer, all the points in the case. I should say his great power of organisation was never better exemplified than when he acted with Lord Vernon's Committee for providing seed for the French peasants after the German war. Like so much of his other work, this, an affair of a very laborious and intricate kind, was undertaken quite as a matter of course, though outside his proper business, and entailing hours of attendance and writing. He did not know what it was to spare himself, and I often wondered how, with his frail-looking form and frequent asthmatic attacks, he kept going at all. I think his travelling so much, though in one way fatiguing, may have procured him rest from brain work which he would otherwise have denied himself. I remember travelling with him from Calais to Paris on one occasion when he was, for him, in good health, and he kept all in the carriage, including three Frenchmen, laughing the whole way. I can understand that to some who were not acquainted with his manner, he might have occasionally appeared abrupt, but he was in truth one of the kindest-natured men I ever met with! and I have often wondered at the way his temper stood the questionings and crosses that beset him during the yearly Exhibitions. He has gone from among us much too soon, and has left none but friends behind."

The conviction—not, however, perhaps, arrived at with certainty till some years after his appointment—may be referred to now, once for all—that the Society had obtained in him a Chief of the Staff, as he may be called, of extraordinary power.

One other preliminary remark may be allowed as to his special ability as Editor. It was referred to by Sir Roderick Murchison in the testimonial which I have quoted. Mr. Carruthers also, the Botanical adviser of our Society, has spoken to me with great admiration of his care in reading MS. before sending it for publication ; and of his correction of style and phraseology, for which, as mentioned in the outset, he had a sort of instinct. "Deft," "adroit," "inoffensive," "often very slight but most effective"—I have heard all these adjectives applied to his work of this kind. The character of the 'Journal' for the thoroughness, simplicity, and excellence of its English, has very much depended on its Editor. How much it owed originally in this respect to the guidance of Mr. Pusey is known by many

a survivor of those early days; and it is the highest praise of our latest Editor that he maintained the high standard then set up.

The material for the number of the 'Journal' which was published immediately after the death of Mr. Frere, had, of course, been suggested, planned, and arranged by the then Journal Committee. Mr. H. S. Thompson, Lord Cathcart, Sir T. D. Acland, Mr. J. Dent, Mr. Edward Holland, Mr. Wren-Hoskyns, Mr. C. Whitehead, Mr. R. Milward, Mr. M. W. Ridley, Mr. J. Carter, and the Right Hon. The Speaker, were the very strong 'Journal' Committee of that day; and, scattered as they were over the counties, and representative as they were of both the ownership and tenancy of land, and interested as they were both in various branches of the sciences of agriculture and in particular departments of its practice, there could be no doubt that the current circumstances, needs, probabilities, and possibilities of agriculture were thoroughly well understood by them. The immediately succeeding numbers of the series would also naturally be due more directly to the Committee than to the Editor, who, at first acting simply on instructions, would not assert himself in any marked degree till later on. The first 'Journal' with which he had to do contained Reports on the Farming of Middlesex and of Staffordshire, on the Agricultural Lessons of the dry year 1868, on the Succession of Green Crops throughout the year, on the varying Price of Wheat, on the Retention of Moisture in arable land, on the Devon Breed of Cattle, on the general subject of Climate as affecting agriculture, together with a series of Farm Reports which Mr. Jenkins and others had been commissioned to prepare. The young Editor had been taken cordially by the hand by many of the practical members upon the Council. Mr. Jacob Wilson and Mr. Charles Randell guided him through the counties, western, eastern, midland, northern—the latter accompanying him to Wiltshire, where Mr. Rawlence's farm management was explained to him; the former to Northumberland, and beyond it across the Border to estates near Netherby, where Mr. Gibbons, of Burnfoot, was then, as he still is, a representative man; over Mr. Laing's fine occupation on Tweedside, near Coldstream; and over characteristic farms in Mr. Jacob Wilson's own neighbourhood. In addition to these he studied Mrs. Jordan's farm management near Driffield, and Mr. Torr's near Grimsby; inspecting also Mr. Hudson's Castle Acre Farm, Mr. Jackson's at Tattenhall, Cheshire, and Mr. Bomford's light land and heavy land farms in Worcestershire. There never was a better agricultural schooling nor a more apt agricultural scholar. The young

geologist had rare powers of observation, rare powers of seizing upon the essential part of any subject that lay before him, and rare powers of subsequent description. And no one reading the seventy or eighty pages occupied by Mr. Jenkins's reports of several of these farms could imagine that the writer had but a year before acknowledged that agriculture was a subject new to him. Each farm is described geologically; and the practical management, whether of labourer or of labour, of plough land, grass land, live-stock, and of estate improvement and equipment —is thoroughly discussed; and any special point deserving separate treatment is specially noticed. The protection of the buyer of artificial manures by guaranteed samples and analyses is pointed out. Exceptional and catch crops have justice done to them. Cabbage cultivation is described. The Shorthorn herd, the Leicester flock, and the small white pigs at Riby have their history related. The management of light land in Nottinghamshire—Forest Farming, as the article is entitled—is one of his subjects. Mr. Hudson's celebrated Castle Acre Farm, Norfolk, occupies another of his reports; it was written in the year of Mr. Hudson's death. His loyalty to the simple four-course system of cropping, and his gradual abandonment of the exceptional catch crops—vetches, early peas and rye—are all carefully described. Mr. Bomford's farming at Pitchill in Worcestershire, and on his heavy land farms at Grove and Tylesford, is the subject of another paper.

Mr. Bomford was an enthusiastic steam cultivator, and an elaborate account of the economy of steam-power on these farms is given. The cleansing of foul clay-land is described field by field—successive fallows, clay burning, mowing the twitch, and burning the land; steam cultivation, with every alternate tine of the drag removed lest the tool should be choked— the young *savant* is already familiar with the various field phrases of the steam-cultivator, and he speaks of the soil being smashed, and burst up, and otherwise shattered, like the "old salt" in these matters which he rapidly became. In addition to the farms here named, Mr. Jenkins visited Cheshire for the first time that year, going over Mr. Jackson's farm at Tattenhall, along with Mr. Statter, then a Member of the Council. It was, however, to the ordinary farm management, not to the dairying, that he referred in his report. One pregnant remark, however, may be quoted from him. "Good cheese-making," he says, "by no means necessarily comes of good farming, any more than good bread is invariably the product of good wheat."

It is of course impossible to go through the successive volumes of the long series edited by Mr. Jenkins in detail. I have

given in a foot-note a complete list of the papers contributed by himself during all the years of his editorship; and it will be seen that, with one exception, each of the volumes contains some of his own work, often a good deal.*

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* The following is a list of Mr. Jenkins's works and articles in the 'Journal' between 1869 and 1886:—

1869	Vol.	V.,	2nd series,	p. 385, *et seq.*	Sundry farm reports.
1870	„	VI.,	„	p. 1, „	Report on the agriculture of Belgium, the result of a journey made at the request of the Council.
„	„	„	„	p. 163, „	Report on Cheshire dairy-farming.
„	„	„	„	p. 173, „	Report on the American cheese factory system and its adaptability to English dairy districts.
1871	„	VII.,	„	p. 145, „	Report on some features of Scottish agriculture.
1872	„	VIII.,	„	p. 325, „	The French Peasant-Farmers' Seed Fund.
1873	„	IX.,	„	p. 187, „	Report on the trade in animals and its influence in the spread of foot-and-mouth and other contagious or infectious diseases, which affect the live-stock of the farm.
1874	„	X.,	„	p. 475, „	Report on the cultivation of potatoes, with special reference to the potato disease.
1875	„	XI.,	„	p. 162, „	Report on the agriculture of Sweden and Norway.
1876	„	XII.,	„	p. 309, „	Report on the agriculture of the Kingdom of Denmark, with a note on the farming of the Duchies of Schleswig and Holstein, with a map.
1877	„	XIII.	„	p. 444, „	On the International Dairy Exhibition at Hamburg.
1878	„	XIV.,	„	p. 269, „	Editor's preface to memoir on the agriculture of England and Wales, prepared under the direction of the Council of the Society for the International Agricultural Congress, Paris, 1878.
„	„	„	„	p. 855, „	On the Royal Agricultural Society of England.
1879	„	XV.,	„	p. 278, „	Report on the dairy-farming of the north-west of France.
1880	„	XVI.,	„	p. 80, „	Notes on market gardening and vine culture in the north-west of France.
1881	„	XVII.,	„	p. 430, „	On flax-farming in the Netherlands.
„	„	„	„	p. 434, „	On the manufacture of artificial butter in the Netherlands.
„	„	„	„	p. 440, „	On the reclamation of peat land in the Netherlands.
1882	„	XVIII.,	„	p. 187, „	On a joint-stock farm in the Netherlands.
„	„	„	„	p. 355, „	On the late Thomas Aveling.
„	„	„	„	p. 521, „	On dairy-farming in the Netherlands.
1883	„	XIX.,	„	p. 155, „	On dairying in Denmark.

In 1870, a Report on Cheshire Farming, and one on Belgian Agriculture, are the result of inspections made during 1869; and in addition to these there is a paper on the possibility of adopting the American system of Factory management in our Dairy districts. The Belgian report is the first of a series by which Mr. Jenkins opened English eyes to the merits of foreign Agriculture. It gives a detailed account of both the "petite" and the "grande culture" characteristic of Belgian farming; and it also gives much detailed information on flax-growing and on other specialities, whether of cultivation or general land management, in that country. The volume to which these three papers were contributed by him contains an unusual variety of agricultural information—Hand-labour, steam cultivation, crop culture (potatoes, hops, mangolds, cereal grains), local agriculture (Monmouthshire, Scilly Islands, Belgium, Cheshire), cattle-foods (straw-chaff, and beetroot pulp), manures (guanos and Chemical Committee's Report); estate equipment; dairy management; river embankments in Oxfordshire, reclamation of Whittlesea mere; implements and live-stock at Oxford. The volume is remarkable for its variety, both as regards the subjects discussed, and the localities and the authorship; and it is striking testimony, thus early in his career, to the vigour, insight and outlook of the Editor, that "the Council refer with satisfaction" in their Annual Report to the General Meeting in December to the two numbers of the 'Journal' published during the current year, "which contain papers of more than ordinary interest." The report on the agriculture of Belgium is especially named as calling for particular notice, and it is added that "it is very creditable to Mr. Jenkins that in the short time which has elapsed since his appointment as Editor he should have made himself sufficiently conversant with both the science and the practice of Agriculture to make and write a report of this high character." Among the local reports in this volume is the first of a now long series on the Prize farms inspected by the Society's judges.—Towards the close of 1870 Mr. Jenkins read before the Society of Arts a paper on the Dairy Factory system in America, and on its relation to the great subject of co-operation in Agriculture, to which reference must be made hereafter.

1883 Vol. XIX., 2nd series, p. 184, *et seq.*	Notes on Continental poultry-keeping.
1884 " XX., " p. 126, "	Report on the practice of ensilage at home and abroad.
1886 " XXII., " p. 171, "	Farming and Agricultural training in reformatory and industrial schools with notes on spade-labour.
" " " " p. 729, "	Notes on the cultivation of tobacco in the north-west of Europe.

In 1871 the Dairy subject still takes the leading place, the volume opening with pages devoted to American butter and dairy factories, and to Derbyshire dairy practice; and Mr. Jenkins's own contribution to this volume gives in full detail the result of his visit to a number of Scotch districts, which enabled him to write on lowland and arable farming in the east and west, and on dairy farming for the milk supply of towns, on Aberdeenshire cattle feeding, and on Highland sheep-farming. The economy of labour in Scottish farming occupies some pages, the advantage and disadvantage of the lease, the competition for land artificially stimulated by the law of hypothec and by the system of tenders for tenancy, the game laws too — all these things are discussed with great fairness; and the discussion is interesting still, notwithstanding the enormous alterations which are being both suffered and effected, partly by means of legislation, and partly by the inevitable influence of market prices. The celebrated agriculture of East Lothian—Mr. Hope's farm at Fenton Barns, in illustration of it—is described; several Ayrshire farms are reported as examples of dairy management; the Aberdeenshire system for the provision chiefly of the London Meat Market, and Highland agriculture—are reported in some seventy pages, devoted to an account of what was to Mr. Jenkins a most instructive tour, which was thus also made instructive to his readers. The Meeting of the Society had been held at Wolverhampton that year; and the elaborate trials of traction and other engines and of steam cultivation generally, form a very weighty and important section of the volume. The Prize farms of the district are again described: this time by Mr. Wheatley. The Report of the Council to the General Meeting in December of this year refers to the subject of foot and mouth disease, and to the restrictions as to movement of cattle which in the general interest were necessary. And to this the attention of the Society and Editor was very urgently directed.

In the volume for 1872, accordingly, Contagious diseases and Veterinary investigations, Reports on the work of the Veterinary College, on Sanitary Police, and on Cattle plague and other veterinary topics, are the leading subjects. Irish agriculture; the condition of the labourer; Mr. Thompson on the formation and management of grazing grounds; a most elaborate report of the lawsuit at Leeds, which was referred to by Mr. Wells as just quoted; and various other official reports from the Society's judges, and from the Consulting Botanist of the Society, Mr. W. Carruthers, F.R.S., who had just been appointed, and by Dr. Voelcker, the Consulting Chemist to the Society, occupy the volume. Mr. Jenkins's own contribution to this Journal is his account of the French Peasant-Farmers' Seed Fund,

to which, however, I must refer further on when considering his many labours outside his duty to the Royal Agricultural Society.

In 1873 the health of stock is again distinctly the dominant subject; Professor Simonds on the general question, and Professor Brown on the foot-and-mouth disease and on other contagious disorders taking the lead. I need not refer at length to the other portions of a most varied table of contents. Mr. Jenkins's own contribution is an account of the trade between Ireland and England in the live stock of the farm; and a most graphic picture it is of the recklessness of the cattle traffic, whether within or between the two countries. Having the note-book before me which Mr. Jenkins filled as he travelled to and fro, and from which as well as from public documents his paper was subsequently prepared, I am very deeply impressed with the industry, detail, and completeness of the enquiry which he conducted, and with the fulness of its results. The following notices are compiled from his memoranda.

On August 24th, 1872, he was in Dublin, and his conversations with Professor Ferguson, with Mr. Bourke, the Under-Secretary for Ireland, and with Professor Baldwin, then of Glasnevin, are recited. At Drogheda on the 26th he saw a crowded fair of animals exposed in the open streets, "some dribbling at the mouth and looking queer"; fifty went off by boat to Liverpool, 30 being between decks, where they raised the temperature to 80 degrees, "which was not considered high. The smell, almost overpowering, irritates the eyes, and animals come out nearly blind in a profuse perspiration." They are immediately unshipped and sent off by rail to Manchester and elsewhere. August 29th at Mullingar a large fair—"cattle packed in the trucks as closely as possible—counted 14 in some of them. In one case sheep put in with beasts had to be taken out shortly afterwards, gored horribly; these beasts had been driven to the fair, would go 50 miles to Dublin next morning, on to Holyhead." Then follows a section of the "Juno"—poop-deck, 'tween decks, upper hold, lower hold. He followed them to Holyhead on the 29th, temperature of the hold 79°, "the vessel well ventilated, with wind sail, which is sufficient in a breeze." August 31st, at Bristol, saw the *Juno* and *Sabrina* arrive from Cork crammed with cattle, sheep, pigs and horses in three holds below the deck; and animals stood in each, as well as on the deck and on the poop. Temperature on arrival 80 degrees. The inspector said that he had no power to stop animals affected with foot and mouth, unless they came from abroad. The details of the arrangements both at Bristol and at Liverpool and at Holyhead are

described, sections are given of the modes of ventilation, which might be made available for ships, and were actually in operation in the Bristol sewers. "It should be noted that the voyage to Bristol includes seven miles up the Avon, where there is little or no ventilation unless there is a strong breeze." Bristol fair is described—"the cattle market is a large yard enclosed by a stone wall, floored with limestone blocks, divided into sections by walling, all the walls and floor well cleansed after every market;" and arrangements generally are praised. Full details are given on the following day of a foot-and-mouth-diseased cow which had been brought from Stone exactly three weeks before; and the possible history of her infection is elaborately discussed. At Cork, on September 4th, again we have the miseries, and what attempts to lessen them had been made, elaborately discussed. September 7th at Waterford, September 9th at Cardiff. He has been zigzagging across the Irish Channel, investigating elaborately and entering fully in his note-book, day by day and on the spot, every detail of information he could gather. At Hull on Sept. 17th, at Hamburg on Sept. 20th, at Hull again on his return, at Dublin on Oct. 3rd, and Ballinasloe on Oct. 5th, where the details of the big fair are described,—"thousands of cattle packed in an enclosure without divisions for separating the lots, all attempts at inspection therefore altogether abortive." At Liverpool on Oct. 7th, at Rotterdam on Oct. 11th, at Deptford on his return—statistics, individual items, memoranda, questions and answers, conversations, all elaborately reported—surely there never was a more exhaustive investigation carried out, with more constant persistence, to its conclusion.

It would prolong this memoir unduly if I were to describe the following volumes in detail; therefore, for the most part, for the future Mr. Jenkins's work as a writer rather than as an editor will be referred to. It may, however, be mentioned here that the statistical preface to the several volumes is, under his guidance, becoming fuller, both more extended and more detailed, as the years run on. In 1874, I find that not only is there the usual abstract of the agricultural statistics of the year, but that the number of men returned as agricultural labourers in successive decades forms the subject of a table; and the density of the live-stock population of the country in comparison with that of its human population is extracted from the Census of 1871. The Irish butter trade too is the subject of one of the paragraphs in this section of the 'Journal.' Mr. Jenkins's own contribution to the volume for 1874 is a Report on the Cultivation of Potatoes, with special reference to the potato disease. It was to some extent the outcome of a prize which had been offered by Lord Cathcart, then President, in connection with that subject. An

elaborate series of questions were sent out to experienced potato growers, evidently drawn up by a man having touch of both the practical and the botanical side of the question. The volume is unusually full also of foreign agriculture; and Professor De Bary is quoted in connection with the potato disease. The Vienna Exhibition, and the Prize-farm Competition, and Austrian and Hungarian agriculture are among the subjects of these pages; the last two being referred to in a letter from Mr. H. S. Thompson when he was travelling as a young man in those countries—which is quoted in the sympathetic memorial notice of him written by Lord Cathcart.

In 1875 there was a long report by Mr. Jenkins on the agriculture of Sweden and Norway, occupying 100 pages. Its table of contents includes the physical aspects of the country, its general agricultural system, cultivation, harvesting; live-stock, horses, cattle, sheep, and pigs; dairying, farm-labour, agricultural institutions, taxation—a most elaborate and complete report; one of the first of those by which the author opened the eyes of English agriculturists to the fact that they had much to learn from other countries. Here for the first time the revolving butter-worker is made known to English dairies; and it has since had much to do with good butter-making here. I have also the note-book of this year before me, containing the material for his report collected day by day as he travelled through the country—a better packed series of little pages never before contained so much agricultural information. There are within the size of an ordinary pocket note-book complete accounts of more than 30 different farms in the countries visited. The general aspect of the country through which he passed is described; detailed particulars of dairy management and of field and general farm and estate management are given in all these instances. Farms of 500 to 700 acres and upwards; and smaller farms, peasant farms, large estates, royal farms, farms of various sizes—of 2 to 4 horses, 10 to 20 cows, 50 to 100 "tonneland,"—1 horse per 100 Norwegian malle; 1 acre, we are told, is $4\frac{1}{4}$ Norwegian malle. Off Norwegian farms in general not more than *2l.* to *3l.* per acre are got annually; off the royal farms it is about double this. A particularly detailed and interesting account is given of Mr. Swartz's farm at Hofgården, near Wadstena. Barley, sugar-beet, potatoes, peas, fodder (such as vetches, mustard, mixed oats and barley), bare fallow also:—all these are described. A large dairy of 150 cross-bred cows, elaborate tables of expenditure, and cost of calf at 4 months, 8 months, 12 months, 16 months, 2 years old—the wages of labour and the details of cultivation—are given in surprising detail. Mr. Dickson's farm at Kyleberg is described: turnips,

carrots, lucerne, other crops; stock management too; and dairying—all full of information for the English farmer. Many of the Norwegian farms also are full of the useful information, which the reader will find condensed and arranged in 100 pages of this year's volume.

Mr. Jenkins's own contribution to the volume for 1876 was a report on the Agriculture of Denmark—seventy pages, containing agricultural notes of a country which had been very early recognised as offering useful agricultural lessons for Great Britain; for Captain Stanley Carr's report on Holstein was welcomed forty-six years ago by Mr. Pusey, our first editor, in the very first volume of the 'Journal.' The report of 1876 refers to the land laws, the agricultural statistics, and the physical features of the country; its general agricultural equipment, its cultivation, its dairy husbandry, its meat production, its labourers and schools; and there are full descriptions given of many typical Danish farms. It is a very instructive report, and nowhere more so than in its account of Danish dairying, describing breeds of cattle and modes of management. Professors Jorgensen and Segelcke are named: and full credit is given to their labours for the improved agriculture of their country—credit which was already due, and may now be still more deservedly acknowledged.

Reference may be made here to the Report of the Council at the May Meeting, 1875, especially for the urgency which it reports as having been brought to bear on the Government in respect of the measures necessary to restrict the extent and intensity of the annual outbreaks of Cattle disease. The passing of the Agricultural Holdings Act (1875) is also referred to, and the intention to publish it with analysis and explanations is announced. In both of these particulars the courage of the Society in the discharge of a clear duty to its members without too careful or anxious a regard to the conditions of its charter, and the advantage of an Editor and Secretary unbound by prejudice or over-caution, may, I think, be recognised.

The volume for 1877 contains another Dairy report, for to a large extent the former, too, was on the dairy industry of the countries visited. Here we have Mr. Jenkins's report on the Industrial Dairy Exhibition at Hamburg. Milk and milk products, condensed milk, fresh butter, salted and cured; keeping butter made in winter, or in summer and autumn; melted butter, artificial butter and other sorts—are all referred to. Of the last there were eleven specimens made by M. Megé's process from animal fat. "Like melted butter," says Mr. Jenkins, "doubtless a useful article in the kitchen,

but not likely to supersede the real article for direct consumption, except to the extent to which it is used as an adulterating ingredient." Cheese also, of which there were no fewer than 359 specimens exhibited, from almost all the European countries—and the implements of the dairy, too—as they also were exhibited—so they also form a section of this report. The Health of the Live-Stock of the Farm was again the most prominent subject with which the Council had to deal during the year. Representations to the Government, a deputation to the Prime Minister, and whatever other means of urgency were available, had at length resulted in the appointment of a Select Committee of the House of Commons to enquire into the whole subject of cattle plague and the importation of live-stock; and Mr. Jenkins had his hands full at this time in securing the examination of practical and scientific witnesses, both agricultural and other.

In the Report of the Council of December, 1876, it had been announced that M. Drouyn de Lhuys, President of the Société des Agriculteurs de France, had intimated the intention to hold an Agricultural Congress in Paris in 1878: and the French Society were desirous that the Council of the Royal Agricultural Society should obtain a memoir on British agriculture to be laid before that Congress. The report was accordingly prepared, a number of the most capable men in every department being engaged by the Editor to write, each on his own department of English farm practice; and in 1878 this report filled one half of the 'Journal' of that year. The important paper prepared by Mr. Jenkins on that occasion had thus been previously published in France, along with other discussions of the various branches of English agriculture, as a contribution to the proceedings of the International Agricultural Conference at Paris. His subject is the Royal Agricultural Society of England: and the treatise—for so it may be designated—refers in its several chapters to the constitution of the Society, its influence on the practice of the farm, its enlistment of the sciences of agriculture for the use of its members, its work in what the author calls the propaganda of agriculture, its efforts for agricultural education, its relations to veterinary science, its guidance of the landowner and the labourer, and the retrospect of the ten years preceding its date, during which, as it happens, Mr. Jenkins had been Secretary. Its membership in that period had increased, its Journal had become more popular, farm prizes had been established, the systematic testing of agricultural machinery had been improved, scientific investigation into the diseases of plants and animals had been conducted, the technical education

of the veterinarian, the tenant-farmer, and the land-agent, had been stimulated, the services of a Consulting Botanist and Entomologist had been enlisted, an experimental farm had been established, and a system of exposing frauds in the food and manure markets had been organised and fearlessly carried out. It had been said that a man should be strong at thirty, wise at forty, and rich at fifty: ten years before, the Royal Agricultural Society had completed its first period, and its 5500 members might be considered strong in numbers and in influence; its action during the next ten years had established its claim to the quality belonging to that stage of existence, and he had no doubt that "at the end of another ten, without any diminution of strength or wisdom, it would be rich, enabling it to carry out the great object for which it was established."

In 1879, Mr. Jenkins reported on the Dairy Farming of the North-West of France. The geological map accompanying his report includes the whole territory north of the Loire and west of Auxerre. Cattle and cattle-management, the milk industry, and the dairy, butter-making, the butter trade, and cheese-making—hard, and soft, and special—are described; and the whole is a most instructive account of a big industry in which English agriculture had much to learn; and in which, thanks to Mr. Jenkins, much of what it needed has been learnt. The two conditions on which the improvement of the butter industry in this country depends are the raising of the bulk that is turned out to the standard already belonging to the best dairies among ourselves, and the bringing about a uniformity of quality. In these two points lay the urgency of his lesson. The firm conviction that sour milk carries a mixture of curd with its cream, and that for every shilling thus gained in quantity five shillings are lost in quality, was what gave its urgency to the first lesson which had to be learnt; and the combination of farmers in order to ensure the uniformity of their combined produce was the point on which he insisted on the other hand. The cheese manufacture also is described—the various soft cheeses, both fresh and cured (no fewer than two dozen sorts are named), and the hard cheeses (Dutch, Roquefort, and Gruyère), are all described; and the marketing business is referred to emphatically.—"My cheese-manager said to me the other day, 'Look at this French box. I open it,' and he did; 'here is the butter fit to weigh out to you without an atom of loss. Now let us break open this cask of Irish. You see I have to scrape it all round, and I lose a lot, beside the trouble.'" Is the contrast thus asserted now happily out of date? To a large extent, no doubt, it is; we have at length very generally learnt our lesson, and to Mr. Jenkins belongs much of the credit of having taught us.

This was the year of the Kilburn Show, where foreign agriculture had a remarkable illustration both as regards its breeds of cattle and its dairy produce in the Show-yard; and where Mr. Jenkins's own proposition of a historical display of the implements of English agriculture was carried out; where the Society, we may add, lost such a quantity of money, owing to the weather, and won such a quantity of reputation, thanks to the energy and wisdom of its leaders, on which, after all, money and prosperity depend.

The volume for 1880 has several of Mr. Jenkins's extensions of his wonderful note-book as a traveller; the details of market-gardening, and the cultivation of particular crops, and the character of the *petite culture* generally in the North-West of France are discussed and illustrated.

Thanks to the energy of the many Committees into which the Council of the Society divides itself, the 'Journal' has been gradually becoming more full of every extension of scientific and practical information. This is seen in the reports of the officers of the Society—its chemical and botanical and entomological advisers. Dr. Voelcker and Mr. Carruthers, and now Miss Ormerod, its official authorities, have been always full of life: and Sir John Lawes and Dr. Gilbert—wonderfully public-spirited volunteers—are still as fruitful as ever they have been.

In 1881 Mr. Jenkins contributes, from his Netherlands note-book, papers on flax-growing, on artificial butter-making, and on peat-land reclamation. They are extracts from his Report to the Royal Commission on Agriculture, on which throughout the year he had been at work, as we shall have hereafter to relate.

In 1882 further Reports on Netherlands Agriculture, and in particular on its Joint Stock Farming, as illustrated by the experience of Mr. Van den Bosch of Wilhelminadorp, near Goes—a large farm which has been known to some of us for more than forty years, and has always seemed to me one of the model farms of Europe. Dairy-farming in the Netherlands is another extract from the Report to the Royal Agricultural Commission. A further contribution from his pen is a memoir of his friend Thomas Aveling, who had been an efficient member of the Council.

In the Volume for 1883 there are still further extracts from the Blue Book of the Royal Commission—this time on Dairying in Denmark, and on Continental Poultry-keeping. The Volumes appear to be increasing in the attention which they now pay to the Live Stock of the Farm; Half-bred horses by Lord Cathcart; Shorthorns in England and Ireland by Mr. J. Macdonald, then Editor of the 'Farmer's Gazette,' Dublin; the Liver-fluke; the History of the Woburn Cattle-Feeding Ex-

periments; reports of Live Stock at the Society's Meetings by Mr. W. Macdonald, Editor of the 'North British Agriculturist': —these form a proportion unusual on comparison with the contents of the previous Volumes of the Journal, as it had hitherto been edited.

In 1884 a similar variety of contents may be recorded.

In this volume one of Mr. Jenkins's most elaborate reports on particular departments of English Agriculture is seen in his exhaustive discussion of the subject of Ensilage, which occupies 120 pages, and is explanatory of methods and experience, and descriptive of the multitude of examples which had been visited.

The Report of the Council this year calls especial attention to the increasing interest taken in the facilities afforded by the scientific departments of the Society. Ten years ago 645 samples were sent to the Society's Chemist for examination—this year the number has been 1628. At the former period the Consulting Botanist received so few samples that the numbers were not worth a record; the previous year he had received 508 samples of seed, this year 701. Similar experience during the short period that her new department had been in operation is reported by Miss Ormerod, the Consulting Entomologist. It is proper to mention any growth of interest of this kind in a memoir of the Editor of the 'Journal,' for, as stated in the Report of the Council, "this number of the 'Journal' contains articles of special interest to agriculturists at the present time, and they cannot but believe that the large increase in the roll of the Society is in some measure due to the estimation in which the 'Journal' is now held by the agricultural community."

The volume for 1885 was the first in which no paper appeared from the pen of its Editor. He was engaged outside his duties to the Royal Agricultural Society of England in an elaborate Report on the subject of Agricultural Education, which is, indeed, one of the most remarkable proofs he had yet given of his indefatigable industry. That the duties of an Editor were not, however, neglected, is plain from the Table of Contents, which is as various as ever. Here, as in previous volumes, we come upon a series of biographies; Dr. Voelcker and Sir Brandreth Gibbs and Sir Watkins William Wynn had passed away, and their services to the Society are recorded.

The volume for 1886 contained two papers by Mr. Jenkins—one on the management of Reformatory and Industrial Schools, which he visited in all parts of the country, in order that the results of spade husbandry might be properly described. Reference is here made to some twenty schools and small farms connected with them, and detailed accounts are given of

very many. I may especially refer to the report of the Barnet example, as he had taken personal interest in the school in his own neighbourhood. The great productiveness obtained under spade culture is illustrated, and a great deal of information of use to those who are interested in small farms is given. An elaborate paper on Tobacco-growing, to which we have already referred as having been in the first place virtually spoken at one of the Committee Meetings of the Council, is the last contribution from his pen. It appeared in the last volume, and in its last part, which he saw through the press but a few weeks before his fatal illness. The experience of tobacco growth in Belgium and in France is described with whatever hopefulness it presents to English growers, and the paper is characterised by all the fulness and fairness which he always exhibited. Not very hopeful that tobacco-growing would be found of much benefit to English agriculturists, and considering the current interest in the subject to be of philanthropic as much as merely commercial origin, he nevertheless states the whole story of experience in the higher latitudes of tobacco cultivation in as instructive a way as possible: and concludes with a reference which throws a hopeful light upon English interest in it—the conclusion, namely, of a French observer, that the best tobaccos are those which are harvested before coming perfectly to maturity.

The Secretary of the Society.

The editorship and the authorship came to an end with the last number of the 'Journal.' It was published in November last year, and his life work closed in the following month. He may be said to have died in harness, for his last letter on the business of the Society was dictated from his death-bed. It must not however be supposed that the editorship and authorship were anything like such a proportion of his work as from this account of them might be imagined. He was Secretary as well as Editor; and the multifarious character of his duties as secretary has already been to some extent declared. His organising power, constantly required, was remarkable. It was one of his most striking characteristics; and I may relate here one example of what was every year exhibited, occurring though it did on an exceptional occasion during the last year of his life. I have before me the scheme of the visit to the Woburn Experimental Farms, where a number of our Colonial visitors last year spent a day on the invitation of His Grace the Duke of Bedford. Two special train-loads of visitors had to be provided for, and

their movements from starting till departure arranged and directed throughout the whole day. This included visits to many separate sections of a complicated series—occasional lectures being delivered—time being allowed for each—punctual arrivals and departures arranged for—reception and luncheon at Woburn—the whole interval between 9.45 A.M. and 6.30 P.M. accurately forecast; carriages to set down and take up at definite points, tickets on two railways to and fro to be given up, carriage number to be retained, &c., &c. This day's work—most successful prosecution of a most elaborate programme—may be referred to as a typical example of the organising power to which I have referred. But any judge of farms for the Royal Agricultural Society knows how perfectly everything was in like manner arranged beforehand—the preliminary meeting with the local authorities, and the programme laid down for our guidance—and last, not least, the pleasant evening together afterwards under his chairmanship.*

Nor was his organising power the only faculty in exercise. I have already referred to his work in connection with the Committees of the Council. Let me quote an old member of Council, not only on this subject, but on the great and crucial question of the financial position of the Society after the disaster at Kilburn. He says: "The real work of the Council is done by the several Committees, thirteen in number. But the monthly business brought before each of them has been previously considered by the Secretary. How much the labours of these Committees have been lightened and made satisfactory to themselves by this application of Mr. Jenkins's marvellous ability is known only in Hanover Square. The working members of the Committees will long look with grateful remembrance upon the help he gave them, and with the deepest sorrow for his loss. After the disastrous Kilburn Meeting, which entailed a loss of about 15,000*l*., the state of our finances was a source of anxiety to our Secretary and other members of the Council. Various means of recovery were devised, discussed and adopted, in all of which Mr. Jenkins was the leading spirit. Increased work devolved upon him, and with it there always seemed increased power of dealing with it, until at last he had the satisfaction of seeing his efforts rewarded by the restoration of the funds to an amount exceeding that at which they stood before the Kilburn Show."

* The merriment of the atmosphere in which he lived was as noteworthy as the precision of his arrangements. Professor Fream relates, of the last Woburn visit, a conversation overheard:—"And what are we going to see? What are the forces in operation whose results are to be explained to us?"—"Nitrates, Phosphates, and Muck," was the reply. "These three—but the greatest of these is Muck!"

His influence by comment and suggestion regarding topics coming before the Council and Committee could indeed be illustrated at any length. From among the evidences of this lying in the minute- and letter-books at Hanover Square I select an example, in which he calls the attention of the Chairman of the 'Journal' Committee to a suggestion which had been made by Major Craigie, at a General Meeting* of the Members for the publication of the 'Journal' in more frequent parts. He says:—

"I have received and placed in the 'Journal' Committee-book the suggestion made at the last General Meeting of Members. It does not strike me that the case is strengthened which was made when the same suggestion was brought forward some years ago. If a number of tenant-farmers had maintained the proposition that the 'Journal' would be more timely and more useful and more widely read if issued quarterly, I should have been disposed to say then, 'I think the Council ought to consider this expression of opinion very seriously, with a view to making the 'Journal' more popular with the Members.' But as a matter of fact the 'Journal' never was so popular with the Members as it has been the last ten years. No one else has ever made this suggestion, and now the proposition is not very logically defended, for it is forgotten of the 'Journal of the Statistical Society' [which had been quoted as a parallel] that the papers contained in the 'Journal of the Statistical Society' are read *before* they are *published*, whereas those in our 'Journal' are *published* before they are *read*, except, of course, by the authors and editor. The greatest difficulty we have, in fact, is to induce farmers to read it at all; and it was thought many years ago that after spring seed-time and after harvest were the two periods of the year when farmers had most leisure and would be most likely to read. The founders and original Members of this Society were eminent and energetic men, and they began by publishing the 'Journal' quarterly, but in the second year only three numbers were published; in the third there were nominally three, but actually only two; and ever since the 'Journal' has been published half-yearly. In those days the Agricultural Press was not so efficient as it is now, so that there is less reason, as it seems to me, for a more rapid publication now than there was then. I have always been told that if there is no great demand for a change the *onus probandi* lies with those who advocate the change; and I venture to submit that it rests with others to prove that a quarterly issue of the 'Journal' would be so much more palatable to the Members than the present half-yearly issue as to justify the Council in going to the increased expense.

"The issue of an occasional supplementary number is a totally different question, and I think that this stands on safer ground. To a very small extent the principle has been adopted, as, for instance, in the issue of Miss Ormerod's diagrams and my little butter pamphlet, neither of which was published in the 'Journal.'"

Here is another letter bearing on suggestions with reference to the 'Journal'—this time addressed to a correspondent:—

"January 14th, 1886.

SPECIAL CROPS.—"Although it will give me pleasure to place your letter before the 'Journal' Committee at their next meeting, I ought also to say that in my several reports on the Agriculture of foreign countries

* December 10th, 1885.

published in the Society's 'Journal' and by the Duke of Richmond's Commission, I have described the cultivation of industrial crops, such as flax, caraways, &c., which I have thought might be grown profitably in England. The difficulty to be overcome with all of them is their preparation for market, which the English farmer does not understand. This is especially the case with plants used for dyeing purposes, such as woad and madder. The first successful rival to the former was indigo; but now all these plants have more or less succumbed to the competition of coal-tar colours.

"Poppies are grown largely in France for medicinal purposes, but not, so far as I know, for opium-smoking, as the climate is not hot enough to develop the necessary amount of morphia for that purpose. Our climate even in Kent would be inadequate for the successful cultivation of that crop. Still more is this the case with tobacco, to say nothing of the enormous labour bill to be paid. If farmers would read, they could easily learn the possibilities and impossibilities of growing these crops. But after all, the final difficulty of preparing them for market would have to be surmounted."

Among the services which ought to be recorded, of which no public evidence exists, were those which Mr. Jenkins rendered to the many correspondents, foreign as well as English, who continually applied to him for information. This is a point to which more than one of my own correspondents have called my attention. I quote one or two examples from the letter-book of the last year of his life.

The subject of Tobacco-cultivation, just mooted, is again discussed in a letter written on 27th February, 1886, which may be quoted in connection with his elaborate report on the same subject, which was the latest work he accomplished:—

Tobacco Culture.—"I regret to say that I am unable to give you any information with reference to the growth of tobacco in the British Islands.

"My own opinion on the subject is based on my practical knowledge of the growth of tobacco in the North-West of Europe, and I fail to see that the fact of its having been previously grown in the British Islands is more conclusive that it could again be profitably grown, than the fact of grapes having been grown and wine made in England in the reign of Edward II. proves that grape culture and wine-making would be profitable in England at the present day. This, however, is of course a matter of opinion, and it would be very desirable if the Government would either itself conduct, or allow private individuals to conduct a series of experiments with a view to demonstrate whether tobacco and certain other industrial crops can be profitably grown in England at the present day, in face of the existing competition from more favoured climes."

"November 1st, 1886.

On Winter Coats for Dairy Cattle.—"The 'mantles' are used extensively in Holland, where they are called, to translate the Dutch term, 'chemises.' I have no doubt that almost any draper in Rotterdam or Schiedam or any other town in that district could supply them. I will write and ask a friend of mine to send me a list of prices from one of the makers, and on receipt of his reply I will send it to you. I shall always be glad to give you any facilities for consulting books in the Library of this Society between ten and four, except during the first week in the month, when the Committees and Councils are held, and the rooms are therefore occupied."

"November 5th, 1886.

ENSILAGE.—"Although it is very late and it will be necessary to be careful in making the silage, considering the large quantity of water which it must naturally contain, I do not think the task is impossible. I would endeavour before putting it into a silo to partially dry it in a barn, as you would for the purpose of haymaking. The planks with weights would be a sufficient covering, although they are not jointed; and I should consider a weight of about 100 lbs. to the square foot sufficient; probably less would be desirable. As to the length of time it may be kept and how soon it may be used, these are matters which depend entirely on the condition in which the grass is when it is put into the silo. This can be ascertained by observation from time to time. The best way to feed stock with silage is to mix it with other food, especially dry food, and not to depend entirely upon it. The more moist the silage, the more dry food ought to be mixed with it."

"November 22nd, 1886.

AGRICULTURAL EDUCATION.—"I enclose a syllabus of the subjects of examination for the Junior Scholarships offered by this Society, together with a sample of the examination papers. It is probable that this examination is too advanced for the boys who would attend the schools in small country towns under the scheme which you indicate, but at the same time I do not see that there is anything to prevent the Council of the Royal Agricultural Society from extending their educational efforts, if they found that there was a reasonable chance of the offer of prizes to schools of a still lower grade being fairly responded to.

"At the present time there is nothing in England which may properly be called primary agricultural instruction, and the Educational Department have not taken any steps towards carrying out the recommendations of the Royal Agricultural Commissioners on Technical Instruction based upon my detailed report to them."

On the 16th of the following month I find a last letter in the letter-book, dictated at Barnet, speaking of serious illness, but answering fully an enquiry on the ensilage subject.

Two other agricultural services rendered by Mr. Jenkins may be mentioned—still in connection with the Royal Agricultural Society before the short reference which must be made to work done outside of his official position.

His 'Hints on Butter-making,' published in a pamphlet which has had a very wide circulation, was written at the request of the Council of the Royal Agricultural Society. The simplest instructions are given, and yet they are elaborately complete:—Milk is not skimmed early enough; it thus becomes sour and takes up curd, which may increase the quantity but injures the quality and price; there is great carelessness in making it, the butter-milk being left in it; the neighbourhood of dirt and foul smells, the effect of unskilful milking, and of bad food and bad water; the imperfect washing of vessels:—all these subjects are discussed. The best English butter is the best in the world, but the difficulty in marketing it lies in the impossibility of securing uniformity. Two pats had been sent to Tooley Street, which were first-rate. The answer was, "If your

friend can send us 10 cwt. a week of this quality we shall be glad to correspond with him." Two pats could be made perfect; of a thousand there was no hope.

His descriptive 'Guide to the Working Dairy in the Showyard at York,' the second of the publications to which I referred, is a capital proof of the thoroughness of all he did. The floor of the dairy—a most important matter; the delivery of the milk; the power employed; butter-making from ripe cream, and from sweet cream; De Laval's and Neilson's cream-separators, refrigerators, churns, butter-workers, can-cleaners for the manufacture in the factory: and Swartz's cooling-can for the farm-dairy, the churns proper there, the butter-workers there, the hardening-boxes there—scales, weights, and all other details: the whole is thorough and complete.

Work Outside Official Duties.

The Society of Arts.—Mr. Jenkins's earliest piece of work outside of his relations to our own Society was a lecture before the Society of Arts on the American system of Associated Dairying and its bearing on Co-operative Agriculture, which is reported in their 'Journal' of December 9th, 1870. The details of factory cheese-making, and its history and possible extension are described, and Swedish, as well as American experience is related. The beginnings of English industry in the same direction in Derbyshire and Cheshire are announced; and he refers incidentally to co-operation in agriculture generally, which this example seems to encourage. The late Lord Vernon presided on this occasion: and among the subsequent speakers were Mr. Nuttall, of Leicestershire, and Mr. T. Rigby, of Cheshire, both well-known dairy authorities.

The Farmers' Club.—Mr. Jenkins' connection with this Club was perhaps the most productive of all his outside agricultural relations. His first paper, a comparison of large and small farms in providing food for the people—to a large extent based upon an analysis of the agricultural statistics of this and other countries—was an extraordinary performance for one who had so lately entered on an agricultural career. It was the subject of an adjourned discussion, to which he contributed "an addendum"—a most elaborate statement of the proportion of food which goes as mere power spent in the work of the farm compared with that which nourishes the population. The paper was printed for private circulation, along with a report on Belgian agricultural statistics. Another paper, written in 1885, and

read before the Farmers' Club in February of 1886, relates to a subject of the very foremost rank in the economy of agriculture. And it was his keen appreciation of that fact which induced him to urge the subject of co-operation for market purposes upon what turned out to be a somewhat unsympathetic audience. The difficulties in his way were pointed out by many of the subsequent speakers, and he himself spoke to me afterwards of the performance as a "fiasco"; but it was far from that, and the weakness in our present system, which he pointed out, is already engaging the efforts of practical reformers, who are stimulated, and to some extent guided, by the arguments which he then adduced.

I may quote here the personal recollections of Mr. S. B. L. Druce, the Secretary of the Club, on the earliest and latest of his relations with Mr. Jenkins. Mr. Druce has told me that he was for some years a member of the Committee of the Club; and that not only had he read several papers, as I have pointed out, but that he was always full of resource in connection with the Committee, upon which he was a constant attendant. He was especially serviceable in selecting subjects for the monthly discussions —two at least of the six for last year were his own nomination. "I consider," says Mr. Druce, "that our great indebtedness to him lies in the light he has thrown on foreign agriculture. Englishmen had hitherto considered themselves A 1 in agriculture, as in every other thing. They have had their eyes most serviceably opened to unexpected superiority elsewhere, especially as regards the dairy management of France and Denmark; but it is also true of the peasant proprietory system, of the general question of thrift, and of the special culture of many individual crops. Mr. Jenkins also opened our eyes to many advantages (amongst some disadvantages) arising from 'La Petite Culture,' and from what are considered the little things of the farm."

LECTURES IN IRELAND.—Reference must now also be made to volunteer work of a less formal kind—duties which he sometimes undertook. The lectures which he gave in Ireland—one at Cork, on Foreign Dairying and Peat-farming; and another at the Dairy Show of the Royal Dublin Society in October, 1883 —show not only his knowledge and his thoroughness, but his aptness as a teacher.

The Cork lecture on "Foreign Dairying and Peat Farming" was prefaced by comparisons of the "extensive" and the "intensive" in agriculture, which were admirably contrasted and illustrated by experience in Holland. Here is an extract;—

"'How can you here win the success which has been arrived at there? I would try to put you on the right way, though a stranger to the country, whose knowledge of your soil and climate is but second-hand, can only speak in general terms. You have a climate, however, so moist that your grass is succulent—even too succulent, it may be, to ensure a certain strength of quality in milk. Because your grass is luxuriant and the feed is sufficient, or more than sufficient, for the stock, it does not follow that the cow should be kept on grass alone. You may indeed go on and feed your cows as hitherto on grass alone, even in wet seasons, and make bad butter; or you may buy more cows and get artificial food to make up for the diminished green keep per head; or you may get rid of some of your land and concentrate your cows on a smaller area, giving them artificial food as mentioned.'"

He who follows the first-named plan is a muddler, going on as formerly; the second must be a capitalist, and understanding the business well; the third, without much capital, has that comparatively rare quality, moral courage. This is the man who becomes an intensive farmer by conviction, the other becoming an intensive farmer by opportunity. He then discusses the whole question of dairy-farming, quoting France as well as Holland; his points being that pasture land may pay; that foreign dairying is so good because the dairy farmers there are anxious to acquire information and to act on skilled advice; and that to enable the dairy farmers of the United Kingdom to improve their results, they must adopt a system of marketing co-operation.

The lecture delivered in Dublin, on "The Duties of a Farmer's Wife," is even brighter and more clever:—

"'To give you an idea of my subject,' he says, 'let us take a shawl and spread it on the floor: we see at once that it consists of two parts; the chief portion is the main body of the shawl, but it is surrounded by a fringe. A farm is like a shawl; it has its main body of duties, which are the province of the farmer; but there is a fringe of duties—the province of the farmer's wife.'"

In France they say that there is no lucrative farm in which half at least of the merit is not directly due to the mistress of the house; and in this Mr. Jenkins thoroughly agrees, notwithstanding that some people have a different opinion. "Only a month ago," he says, "I read the following editorial note in an English Agricultural newspaper:—'Feminine activities are the most obstinately illogical of all natural phenomena.'" "Let us however try to find out the truth,"—and straightway he takes the mistress to the dairy. "You have been lectured over and over again," he says, "on the necessity of cleanliness. Where do you begin to see its necessity? Is it in the condition of your own hands, or that of the cows' udder? or does it only begin with the milk-pail and other dairy implements? How about bad smells? Do you keep bacon or cheese or strong smelling substances in the same room with the milk or cream

or butter?" "In Ireland," he exclaims, "I may be forgiven for saying that there is nothing so fatal to the making of good butter as the neighbourhood of the cleanest pig in the world, unless, indeed, it is that of the dirtiest."

After milking comes the butter-making and the marketing:—"Make it up in such a way that it will captivate the eye; good looks, as every woman knows, count for a great deal with men."

Here, again, is a happy thought:—

"You know the Church calendar and its 'golden number;' if you refer to your prayer-book you will find a more or less recondite means of finding out when Easter Sunday comes by means of a golden number. In butter-making the golden number does not vary so much as that mystical clerical numeral, but it is still liable to variation on account of temperature, ripeness of cream, and so forth. The golden number in butter-making, I consider to be 60; that is, 60 degrees of temperature for the cream, and 60 revolutions of the handle of the churn per minute.'"

Then he describes the manner in which a Danish wife has to a great extent made the fortune of her husband by the management of her dairy.—Poultry-keeping is referred to after dairying, and there is no better chapter on that subject than the six pages in which poultry management is described:—

"There is an old story of a French General who insisted on his soldiers changing their shirts; he was told they had but one apiece; then said he, let them change among themselves. On the same principle, if you cannot afford to buy cockerels of improved strain, make the best exchange you can with your neighbours, for new blood is essential."

Rabbit-keeping—bee-keeping—gardening—all in succession are described; cooking and bread-baking receive attention. The education of the children is the last and most important of them all; and the garden and the bee, and the poultry and the rabbits, help also that. The sowing of the seed, the gradual growth of the plant, have their obvious applications: "As ye sow so also shall ye reap"—the necessity of making provision for the future—all these subjects have their lessons in the garden.

"And the cultivation of flowers fosters that appreciation of the beautiful without which our lives would be dull indeed.—Farmers have had hard times of late years, but by a proper development of the Agricultural fringe I feel sure that we may sometimes again be able, by slightly changing the familiar ditty, to record that—

'Merrily danced the *farmer's* wife,
And merrily danced the *farmer*.'"

DAIRY EDUCATION is another of the subjects on which Mr. Jenkins has more than once written and spoken. At the Gloucester Dairy Conference in 1882 a paper on "Dairy Schools" was read by him, in which, as usual, England is

contrasted with several foreign countries, somewhat to its disparagement:—

"I will ask you to consider," he says, "the position of a young English woman who is about to marry a dairy farmer. Presuming that the bride-elect wishes to learn how to manage a cheese dairy in Gloucestershire, or Somersetshire, or Cheshire, or any other cheese county in England, where could she go to learn both the practice and the science of the subject from beginning to end?"

"We need not pause for a reply," he continues, "for echo immediately answers—where." In Denmark, and Germany, and France, on the contrary, Dairy Schools are common. Now at length, however, at Glasnevin and in Munster, Dairy Schools, he could say, had been formed.

In the same year, three months later, he had occasion to address the company at the formation of the first English Dairy School, which had been established by Lord Vernon at Sudbury in Derbyshire, where office work and book-keeping, and butter-making, and cheese-making, were to be the subjects of instruction:—

"'First,' he says, 'let me remind you that you have come to learn a handicraft requiring deftness in manipulation, together with intelligence in appreciation, especially of the fact that circumstances alter cases. To understand not only what to do, but how to do it, and why you do it, recollect you must concentrate your attention upon what is shown you, as well as what is told you; if you do not, in this, as in all other handicrafts, you will be persons who possess eyes without feeling, feeling without sight, mere machines, such as can be obtained by the hundred. If on the contrary you use general intelligence and industry, you will soon find your reward.'"

I do not think I need illustrate at any further length Mr. Jenkins's remarkable aptitude to teach.

Reports to Royal Commissions.—The two most laborious performances of his agricultural career—as successful, too, as they were laborious—remain to be named,—his Reports to the Agricultural Interests Commissions as an Assistant-Commissioner, and his Report as an Assistant-Commissioner to the Royal Commission on Technical Education. In connection with the former I have been told that to Mr. Jenkins was due not only the special Report which he was commissioned to prepare, but a good deal of the whole scheme and programme under which the Commissioners finally arranged their proceedings. Mr. Jenkins was not himself named on the Commission, but the leading men engaged on it gladly availed themselves of his grasp of the whole subject, and his extraordinary powers of organisation and arrangement; and to him was largely due the elaborate analysis of the inquiry under which the various Assistant-Commissioners conducted the in-

quiry. Mr. Jenkins's own share in this inquiry included Reports on the Agriculture of the North of France, Belgium, Holland and Denmark. These are a library of information, in which national and industrial statistics, local agricultural history, with detailed examples of every branch of farming, are accumulated. They were presented to both Houses of Parliament in 1882, and are the result of successive journeys in the previous year. They meet the wants of almost every reader who shall approach them, whether he be a student or a practical man. In the former case he will obtain all he needs to know of the history of agriculture and its general relations to the industry of the country, the agricultural institutions of the country, and its methods of agricultural education. In the latter case he will find detailed accounts of methods in the field, in the homestead, and in the dairy, elaborate specifications of special crop cultivation, and examples enough of successful management on particular farms.

Mr. Jenkins's Report on Agricultural Education in North Germany, France, Denmark, Belgium, Holland, and in the United Kingdom—to the Royal Commissioners on Technical Education, and through them presented to both Houses of Parliament in the year 1883—is an extraordinary proof of his thoroughness and industry. In an introduction he declares that his object has been to describe not only the highest agricultural education suitable for gentlemen farming their own lands, and for the largest tenant-farmers, and for land agents, but the intermediate education suitable for bailiffs and small tenant-farmers, and the lower agricultural education for farm labourers and peasant proprietors; also the instruction in the rudiments of agriculture given in elementary country schools. This plan he carried out with certain variations, owing to the different agricultural circumstances of the several countries visited. By personal inspection, by correspondence with the authorities in charge of the different educational institutions, by correspondence with Government departments in each of the countries, and by acquaintance with the whole literature of the subject, which has long been voluminous in most of these countries, he accumulated the materials which enable the reader, with whatever want he may approach the subject, or in whatever country he may be specially interested, to find virtually all the information that he requires. His generous appreciation of the labours of previous writers and workers on the subject is not the least interesting of his characteristics, as I for one very gratefully acknowledge.

Speaking of North Germany, he relates the history of his subject during the last 150 years—its progress during the

eighteenth century. The influence of Von Thaer is referred to. Various agricultural institutions of the highest class—high schools or University departments—are enumerated with the subjects of instruction at each of them, and the statistics of attendance, the expenses, and results. The intermediate schools of agriculture, not exactly State institutions, but receiving a State subvention in aid of local funds, are fully described, with elaborate tables of attendance, of studies, and finance. And some account is given of the results in their neighbourhoods—altered rotations of crops, improved machinery, increased growth of fodder crops, improvement of live-stock, better manual labour. Winter schools and travelling lecturers are referred to—a subject in which we ought to be interested. Special schools embracing general education, as well as agriculture—Dairy Schools; Veterinary Colleges; Drainage and Irrigation Schools; Gardening Schools; Schools of Bee-keeping:—All these are enumerated and described. Agricultural experimental stations are mentioned, and the work they do is related. It is certainly a very bright picture altogether; and the country described may be congratulated.

In France the educational system is contrasted with that of Germany—the great French institutions with the corresponding German approximate equivalents. Regional schools, practical schools, shepherd schools, farm schools, agronomic stations are, in France, the more practical form of their more scientific equivalents in Germany; and for the travelling lecturers, 'Wanderlehrer,' as they are called in Germany, there are in France fifty-five departmental Professors. The higher French agricultural schools are described. The pupils are generally sons of Government officers, men who are to be Government officers, who are to be Professors of Agriculture, Directors of Laboratories, or of Sugar-factories, or of Distilleries, Agricultural Engineers, and large tenant-farmers. The detail of the winter and summer sessions, the practical exercises, laboratory practice, discussions, excursions, travelling scholarships, are all enumerated and described in extraordinary detail—payments, receipts, products being specified, down to the various requisites which each student must bring with him, much as in our own boarding-schools at home—"12 shirts," "12 towels," "3 pair of strong boots," &c., &c. Then we have an account of the practical schools of agriculture under the head of "Intermediate Agricultural Education;" and here again terms of admission, subjects of instruction, number of students, domestic arrangements, &c., are described. Under the designation of "Lower Agricultural Education" a number of "farm schools," so-called, are described; *e.g.* La Pilletière, eight miles from Château-

la-Loir, between Le Mans and La Tours—with its 280 acres, Charolais oxen, Shorthorn cows, Leicester-merino sheep, and Yorkshire pigs. The course of instruction is specified, with a daily scheme of study, from 5.30 A.M. to 8.45 P.M. on each day of the week. The influence of the school on the agriculture of the district here also is reported. Other schools are described in same detail; and of the special Schools, as of Forestry, Veterinary, Drainage and Irrigation, Shepherding,—a full report is also given. Then we have the duties of the departmental Professors: and the question of agricultural instruction in Elementary Schools, both of which, as it seems to me, have important English lessons in them. Lastly, we have a report of the Stations Agronomiques, the Concours généraux, régionaux, and départementaux—and the list of Agricultural Societies.

Denmark too is reported on in some detail. The work of practical instruction, and of apprenticeship, the theoretical Schools, the Royal Veterinary and Agricultural College, and the Agricultural Societies, are all described. Professor Jorgensen and Segelcke are named as leaders in it all.

In Belgium we have a State Agricultural Institute at Gembloux, with its 1st, 2nd, and 3rd year's instructions. A School of Veterinary Medicine at Cureghem, and special schools of many kinds, and agricultural stations, are described.

In the Netherlands, the State Agricultural School at Wageningen, with its fees and costs, and plans of study; the State Veterinary School at Utrecht; and a large number of stations and societies are described.

What has Mr. Jenkins to say of Great Britain? He speaks indeed of the recent establishment of a Chair of Agriculture at the Normal School of Science, South Kensington, and of a grant of 150*l.* a year towards the endowment of a Chair of Agriculture at the University of Edinburgh; but this is all that Government does for that part of the Kingdom called Great Britain. Not that we are without agricultural education; and Mr. Jenkins gives a full and most interesting history of the Royal Agricultural College, Cirencester, now close upon its jubilee, which has grown into an institution equal in thoroughness and efficiency to any of those Government institutions which he has described elsewhere. The Agricultural College at Downton—also an establishment without Government aid—is similarly described. And a number of county schools in Surrey, Bedford, Devon, Dorset, Norfolk, Cheshire, Worcestershire, and Westmoreland are enumerated, where a certain amount of attention is paid to the elementary principles of agriculture. The Albert College, Glasnevin, is named; and some reference is made to a number of Irish schools, which have been more or

less the result of Government interference. The Veterinary Colleges in London, Edinburgh, and Glasgow are named. The Science and Art Department, through which alone the help of Government comes, includes both higher instruction by courses of lectures at the Normal School of Science, and the lower instruction in the principles of Agriculture, encouraged by the payment of fees to teachers in Elementary Schools and Science classes. The small grant here made has had the effect of bringing up a large number of candidates, beginning with 150 in 1876, and increasing to 4679 in 1882, of whom 2965 passed the elementary stage, and 1509 the advanced stage, and 205 the honours stage; the examination being conducted by Mr. Henry Tanner and his assistants. It is related that the total number of evening classes in Agriculture at the date of the last return was for England and Wales 193, Scotland 33, and Ireland 126, including altogether 6,176 students, and the grants to teachers amount to 3300*l.* These classes are almost universally held in market towns, and only rarely touch villages, except in cases where a teacher takes a circuit of villages, or small market towns around a larger circle, visiting each place once a week. It is by no means certain that these evening classes, notwithstanding this account of them, do all the work for which they are credited. Mr. Jenkins then devotes some sixty pages to a discussion of the educational work of his own Society, and of other Societies and Institutions, some of which receive no Government aid whatever. The prosecution of Agricultural education is the seventh of the objects for which this Society was incorporated by Royal Charter. The duty is thus laid upon it of taking measures for the improvement of the education of those who depend upon the cultivation of the soil for their support. It is not however in direct educational work alone that the Society has carried out this object of its Charter—its Journal, its relations with veterinary education, its field experiments, and its farm prizes are all of them forces tending in the same direction. Its Examinations and its Scholarships are however direct efforts of the same kind. The work of the Society of Arts and of the Highland and Agricultural Society of Scotland is also referred to; and at length we come to what may be rightly called the great honour and glory of our country, so far as Agricultural guidance and education are concerned—the labours of Sir J. B. Lawes and Dr. Gilbert at Rothamsted. Besides all this due credit is given to the recent efforts to found a Dairy School, which are now at length in process of accomplishment.

Ireland is the subject of a special Report; Glasnevin and Templemoyle, and the Munster Dairy School, and the Travelling

Educational Dairy, and Earl Spencer's Prize-Farm system are all described. There is, in a concluding summary, a comparison of the different countries under the several divisions which have been enumerated; and there is a final chapter of recommendations which well deserves the study of all who are interested in the promotion of Agricultural education. How complete and thorough the whole work has been appears from the index of eighteen double-column pages, containing nearly 800 references.

International Conference on Education.—Mr. Jenkins's paper on Farm Schools and School Farms, read before the Conference during the Health Exhibition at South Kensington in 1882, must be merely named. In it he calls attention to the *Landwirthschafts-Schulen* of Germany, and the establishments known as *Écoles Pratiques d'Agriculture* in France, as the models of school farms which he would like to see established in this country—where there are no establishments of the kind, if we except the "Aspatria Agricultural School" in Cumberland, and the "King Edward School" in Aberdeenshire. The "farm school," on the other hand, is represented in Germany by a large number of *Ackerbaus-Schulen*, and by a score or more of *Fermes-écoles* in France. These institutions, to which reference has been already made, are referred to in detail in the address given on this occasion, which with the subsequent discussion will be found fully reported in the volume devoted to the Conference, published for the Executive Council of the International Health Exhibition (Wm. Clowes & Sons, Ld.). The paper is full of details and suggestions, which ought to lead to practical results—the aim being to help the education, not only of the future farmer, but of the intelligent bailiff, on whose assistance English landowners are becoming to a large extent dependent.

French Peasant-Farmers' Seed Fund.—It is perhaps somewhat out of place to refer here to Mr. Jenkins's services in connection with the French Peasant-Farmers' Seed Fund, at the close of the Franco-German war, for these belonged to his earliest agricultural years. The French Peasant-Farmers' Seed Fund occupied him during the autumn of 1870 and the early spring of 1871. Mr. James Howard, with whom the idea had originated, had corresponded with M. Drouyn de Lhuys in reference to a project for supplying seed to the small cultivators of the invaded regions. The correspondence was published in the agricultural papers at the instance of

Mr. Brandreth Gibbs, and a public meeting was called by Mr. Gibbs and Mr. Delano, representative of the Société des Agriculteurs de France, and Mr. Jenkins; and they were appointed joint secretaries, Mr. Howard, who unfortunately became disabled by illness, acting as hon. treasurer. The late Lord Vernon acted as President of this Committee, which was appointed "to collect subscriptions, and corn and other seeds, to be supplied gratis to enable the small cultivators of France to sow their lands, and thus avoid an otherwise inevitable famine." The whole story is told in Mr. Jenkins's history of the affair in the volume of this Society's 'Journal' for 1872; and Lord Vernon's interest and earnestness in the matter has justice done to it in Mr. Wells's memoir of him in the 19th volume of the 'Journal.' Committees were appointed for every county for the collection of subscriptions. Boards of Guardians, and the Presidents and Secretaries of every Agricultural Society and Farmers' Club and Chamber of Agriculture in the kingdom, were applied to, and a sum of 29,167*l.* 1*s.* 2*d.* was collected, which, when supplemented by the Lord Mayor's fund and the Swedish farmers' fund, and the Limbourg fund, &c., amounted in all to close on 52,000*l.* In addition to this, large donations were made of spring wheat, and barley, oats, potatoes, and small seeds. Inquiries were made in the districts which had been devastated, and the correspondence revealed the positive exhaustion of many of these districts. The period during which they had to be supplied was short, but it was ascertained that spring wheat was sown up till April 1st, and oats and barley for three, or even four weeks later. The wants were, in fact, greater than could be supplied, and it became necessary to give proportionate relief; no persons occupying 50 acres or more were allowed to receive gratuitous relief, and no single cultivator was allowed to have more than 8 bushels of wheat, 12 bushels of barley, or 16 bushels of oats. The preliminaries of peace were not signed till February 26th, but the first purchase of seeds had been made on February 4th. No fewer than 26,246 occupiers were relieved in the departments of Somme, Pas de Calais, and Aisne, and 29,339 in the departments of Indre and Loire, Scarthe, Loir and Cher, Loiret, Eure and Loir; and, in all—3695 qrs. of wheat, 3836 of barley, 5387 of oats, 250 of tares, 700 tons of potatoes, 500 bushels of haricot beans, 250 bushels of turnip seed, 8000 lbs. of carrot seed, 1000 lbs. of onion seed, besides 500 bags of other seeds, were distributed. Captain Delf was afterwards deputed to ascertain results; and his report in the autumn of 1871 gave a most satisfactory account of the harvest which had been obtained,

with the exception of that from the nursery seed wheat, which had not been suitable for such late sowing. "The gratitude of the peasantry," he says, "was unbounded, and much benefit has accrued to the agriculture of France generally by the distribution of new varieties, the value of which had been unknown." The labour of correspondence, inquiry, superintendence of deputed organisers, carriers, &c., was immense, but the result was worth it. M. Drouyn de Lhuys speaks of the volunteer movement on the spot, which was thus directed and supplied. "Delegates," he says, "volunteered their services to distribute relief to our cultivators in their distress, even in the midst of our ruined villages—courageous as soldiers, zealous as missionaries, exact as accountants, on their return they prepared with marvellous accuracy the balance sheets of their novel commercial operations, which consisted in giving everything and receiving nothing." Mr. Jenkins's report in the 'Journal' gives full credit to the share borne by his colleagues, and by the many English volunteers whose labour was thus directed. His own great share in these labours is left to be inferred: the whole story is well worth reading now.

Before concluding, some reference should be made to the occasional use which Mr. Jenkins made of both daily and weekly journals when any agricultural lesson or information needed immediate publication—his occasional communications to the 'Times' newspaper and to the agricultural papers, of which I have grateful recollection so far as the 'Agricultural Gazette' is concerned.

This memoir has been wholly eulogistic. If any hint of fault or failure has escaped, it is in the apologetic tone of one sentence in the most sympathetic and appreciative letter sent to me by Mr. Wells. I was not aware of any abruptness of manner in Mr. Jenkins's relations with outsiders, of which it there appears that some were conscious, but I have understood that his will was always law within the scope of his duties; and that may have influenced his manner generally. Not that his will had to be asserted, but that it was invariably obeyed; all the threads led up to him; and a complicated business such as included all the various organizations working in Hanover Sqnare, could not otherwise be conducted. The Royal Agricultural Society of England has in fact lost a most efficient and devoted servant, whose faults, whether of manner or of any other kind, will be readily condoned by any one who considers the great constitutional difficulty which was his lifelong trouble; and the Society

may well be congratulated if it shall find a successor of equal power and devotion.*

The reader now has before him, too much perhaps in mere catalogue fashion, some idea of a busy life which had been heartily devoted all along to the duties which belonged to every successive stage of it. Schoolboy, student, worker, subordinate, and chief—always resolute, energetic, systematic, urgent, prompt, and punctual in the work he had to do—Henry Michael Jenkins had grown in capability and power from year to year. Every step taken was in advance, whether from one position to another, or at length from one duty to another in the position which he at last achieved, and which he held for nearly twenty years. What were the special points on which his continual success had depended? For my answer to this question I am largely indebted to Professors T. Rupert Jones, P. Martin Duncan, and W. Carruthers, who have been his friends since early manhood, and especially to his cousin, Mr. F. J. Lloyd, F.C.S., with whom he often discussed both the subjects and the objects of his work. He was always singularly receptive, sympathetic, teachable. This lay at the foundation of it all. Not only every subject which he touched,

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* We add here a list of the Medals and Diplomas conferred upon Mr. Jenkins at various dates:—

1870-71. "Souvenir de gratitude," with bronze medal, from "Les Cultivateurs de la Seine."

1871. Silver medal of the "Société des Agriculteurs de France," as delegate of the French Peasant-Farmers' Seed Fund.

1871. Gold medal, "Souvenir reconnaissance," from the "Communes de Montléry et Linas," bearing the motto, "Solidarité des peuples"

1871. French Peasant-Farmers' Seed Fund. Diploma. In recognition of his valuable services as Honorary Secretary, and in distributing seed corn in France.

1871. Diploma appointing him foreign member of "L'Académie Royale d'Agriculture de Suède."

1872. 26th June. Elected Corresponding Member for England of the Central Agricultural Society of France.

1872. Gold medal from the "Ministry of Agriculture and Commerce." République Française." Testimony of esteem, and in recognition of the succour given by French Peasant-Farmers' Seed Fund.

1877. Diploma and Silver medal, "as a proof of great esteem, and as a remembrance of the Agricultural Exhibition at Christiania."

1878. Bronze medal of the "Société des Agriculteurs de France. Congrès international de l'Agriculture."

1879. Mansion House Committee. Gold medal. Her Majesty Queen Victoria, Patroness.

1880. 19th Nov.—Elected an Honorary Member of the Royal Agricultural Society of Hanover.

1883. Diploma of the Dutch Agricultural Society, in recoognition of his services at the Amsterdam International Exhibition.

1884. Gold Medal for his 'Agricultural Reports' (and Agricultural writings generally) at the International Agricultural Exhibition, Amsterdam.

1884. International Health Exhibition. Diploma for services rendered as Judge.

1885. Bronze Medal of the International Inventions Exhibition, and Diploma for services rendered.

but every personal acquaintance he made, became to him a study, and the characteristic intelligence and quality of every one was seized and used for his own imitation or correction. His scientific training and the orderliness of his work, both as student and in his official engagements, were of the utmost service to him. His wide grasp of the whole truth, and his analytic, classifying power over it thus acquired, were of enormous value to him as Editor of the 'Journal.' His special knowledge, too, of many branches of science enabled him. He was himself an expert in many subjects, and could intelligently edit the work of others who were specialists. His literary powers, like all his other powers, came to him of special effort for the attainment of them. To say what he thought or knew in the simplest language was an aim in which he at length succeeded by study of the best specimens of English style. Roget's 'Thesaurus,' a cyclopædia of the English tongue, had early been a manual, and Macaulay had latterly been a model; and these, his own teachers, enabled him to correct the redundancies and ambiguities of others. The knowledge of farm practice and experience which he knew to be essential to his office he set himself at once to acquire; and through the late William Torr, of Aylesby, and subsequently by travel, inspection, and report—north and south, at home and abroad—it was always growing. His acquaintanceship with the best farmers, and the cordial relations which he held with every one, made his work of this kind both agreeable and easy. His special devotion to one particular branch of agriculture—the improvement of dairy practice and of dairy farming—was wise, not only in reference to the possibility of doing good work, but also in reference to the acquisition of general agricultural intelligence. Every student will tell you that the best method of acquiring general power is to direct yourself especially to one branch at a time, and work it out thoroughly—your field becoming gradually widened as its relations to other departments become clear. This was Mr. Jenkins's plan, and it was in connection with this, perhaps even more than in connection with the cultivation of official relations with other countries, that his knowledge of language became of service to his office. His travels in France, Germany, and Denmark, and his reports on dairy practice in those countries, have certainly been of great service here.

These, then, are the qualities on which his career has depended—eagerness, teachableness, and sympathy—loyalty to duty, and system and punctuality in the discharge of it—grasp and thoroughness of scientific knowledge—literary power—and foreign language. Whatever the order of their importance, no doubt can be entertained that both the first two and the last of

these five qualifications are here placed properly. The office is an English office, and the foreign relations of it, important as they may be, are merely incidental to its leading duty, which—identical, of course, with that of the Society itself—is to serve the interests of English agriculturists. Eagerness, sympathy, intelligence lie at the very foundation of the whole. "What is the chief requirement of your office?" the Editor was once asked. "To know now," was the reply, "what will be of agricultural importance six months hence." An eager, able, sympathetic outlook was his most important qualification. That is what his answer really meant.

This eagerness of outlook, this constant loyalty to the Society which he served, amounting to an entire absorption of time, and mind, and power, in the effort to promote its interests and its utility—this large appreciation of scientific truth, agricultural and other, united with exact acquaintance with many of its branches, agriculture at length being one of them—this admirably clear and simple literary style—and lastly, this acquaintance with foreign language, foreign agriculture, foreign agriculturists: these are what enabled our late Secretary, and must qualify his successor. Beneath them all lay a thoroughly honest, resolute, and good-natured personality. No one ever had a clearer sense of right and wrong. Work promised was always set about at once; engagements of all kinds were scrupulously and punctually kept. I may again tell an illustrative story of my own knowledge on this point. Coming from Barnet to the meeting of one of the Juries in charge of the late Health Exhibition at South Kensington, he was told that he had been appointed reporter in his absence. His urgent and quite unanswerable protest on the plea of overwork was of no avail; and at length he unwillingly undertook the task; and the report was brought next morning needing neither alteration nor correction. His work was facilitated not only by an urgent instinct for the completion of it, but by his orderly method in doing it. He has told me that whatever literary work he had to do was always exhaustively thought out and carefully arranged in his mind before taking pen in hand; and thereafter the report or argument or discussion, whatever he was engaged upon, developed and matured on page after page, which he covered with the most perfect handwriting that was ever seen; rarely needing either addition or subtraction or correction when read over for the press. Of his good nature and his resolution there are many memories. I prefer to refer here to his home life only. No one ever more loved his home or made it more his special living interest. Always urgent to return from his many foreign journeys, in which, however, Mrs. Jenkins

was often his companion, I have been told that on one occasion it was insisted that he should remain in order that he might duly receive the official recognition of his services; he found, however, that by starting immediately he could get to Barnet on the Saturday night, and he didn't take the decoration—he took the train. The charm and comfort of the home life were, I may add, the real source and spring of his official success. The town residence provided for the Secretary at the Society's house in Hanover Square was soon found to aggravate the asthmatic trouble which was his life-long difficulty; and he went back to New Barnet, where he had formerly established himself soon after his marriage. And there from day to day he spent his evenings, as his mornings, mid-days, afternoons, had been spent, in the service of the Society. There he wrote and there he worked, ever revolving the aims, and interests, and efforts of the Society—meditating new subjects, planning new projects, enlisting new allies. The courage and the resolution, to which reference has been made in connection with his official life, continued till the last. The unusually severe access of asthmatic weakness from which he suffered in December—he was unable to be present at the General Meeting of Members on the 9th—was aggravated later on by an attack of bronchitis, and he lost power from day to day. And often as he had before recovered from illness of this kind, he foresaw that this was to be the last. The end was, indeed, close at hand. Not imagining immediate danger, his wife had urged him once more to try and take the medicine which had been sent. It was early in the morning before Christmas Day, and he died almost immediately afterwards. To the last he was clear, resolute, and strong in mind and will, and his last word was characteristic of the man. "I will, my dear," he replied with difficulty, and again emphatically, "I WILL!" *

The funeral took place on Thursday, December 30, at East Barnet Parish Church. Our late President, H.R.H. the Prince

* Mrs. Jenkins is left with three sons and three daughters—the two youngest still at school. The education of all had been planned and prosecuted always with a distinct end in view. The eldest son, now twenty-one years of age, was at the Cranleigh County School for a while, afterwards in the office of Mr. John Thornton, well known to all stock-owners, and subsequently at the great French Agricultural School at Grignon; and he has since been among the ranchemen of Western America, where he is, I believe, still working in the intended groove. The second son, intended for land agency, has been educated in Germany and also at the Bedford County School, and has distinguished himself there and since elsewhere by the position he has taken in all his examinations. He won the junior scholarships of the Royal Agricultural Society in 1881 and 1882. He has since passed at the head of all competitors in the examination before the Surveyors' Institute. He has latterly been with Mr. W. B. Canning, and with Mr. G. M. Allender on his dairy farms near Horsham, acquiring a knowledge of the practical side of agriculture.

of Wales, and our President, Lord Egerton of Tatton, added their wreaths to those by which the coffin was covered. Mr. Wells, a former President, and many members of the Council, were present, besides representatives of various agricultural and other societies and agricultural journals.

Postscript.

The Society has since received from the Société des Agriculteurs de France, of which Mr. Jenkins was Foreign Correspondent for England, the following extract from its minutes:—

"M. Louis Passey, Permanent Secretary, announces to the Society the death of Mr. Jenkins, Foreign Correspondent, and expresses himself in these words:—'I have the painful duty to announce to you the death of Mr. Jenkins, the eminent Secretary of the Royal Agricultural Society of England, Foreign Correspondent of the Economic, Statistical, and Agricultural Legislative Department. Mr. Jenkins died on Wednesday morning, 24th inst. (December), at his residence at New Barnet. His death is a loss difficult to replace to the Society to which he had belonged for more than twelve years, and to which he had given an activity, and a vitality, without precedent, whether by the ability with which he managed the annual meetings, or by the variety of his works.

"'In spite of his official occupation, as Secretary of that illustrious Society, Mr. Jenkins had devoted his energy to vast enterprises of enquiry under the patronage of the Royal Commission appointed to enquire into the question of agricultural depression, and presided over by the Duke of Richmond. An intrepid explorer, as well as a conscientious observer, he was charged with missions in France and in Holland, which resulted in his sending to his Government reports full of information and valuable intelligence, which are hardly of less interest to us than they are to his fellow-countrymen.

"'His papers, published in the 'Journal of the Royal Agricultural Society,' treat of many questions of great interest even for France. I would distinguish amongst the most important his works upon ensilage, upon the milk industry of Denmark, upon agricultural education, and most recent of them all the memoir upon the culture of tobacco in France, in Belgium, and in the Palatinat, which appeared in the last number of the Journal of the Society, and which constitutes the most complete *résumé* of everything which concerns this industrial cultivation from the three points of view, the cultivation of the plant, its economical importance, and its fiscal value. We lose in Mr. Jenkins more than a member of our Society; we lose a friend of France. He loved and appreciated our country; and if I am not mistaken he desired that his children should be educated here.

"'On these various grounds our loss is at least as great as that of our neighbours, and I believe that I rightly interpret the wish of our Society in proposing to send in their name to the Society with which he was more directly connected, a letter of condolence, which may express our regrets.'"

On the first subsequent meeting of the Council of the Royal Agricultural Society of England, the President, Lord Egerton of Tatton, thus referred to the loss which the Society had suffered:—"Mr. Jenkins possessed a marvellous combination of

talents which fitted him for his secretarial duties. He was able to rapidly acquire knowledge which he could reproduce in a clear and readable shape. Further, he had a full grasp and knowledge of all agricultural topics, and spoke with facility two foreign languages at least; whilst he had by his energy and ability greatly increased the operations and influence of the Society; and his power of work increased with the work he undertook. He had been so long Secretary of the Society that he was thoroughly identified with its growth, and his loss will be felt, not only by this Society, but by agriculturists at large all over the world. Our first duty will be to pass a vote of condolence to Mrs. Jenkins and her family. I am sure that this will be universally received as one of the marks of respect we can pay to his memory."

Earl Cathcart, the Chairman of the Journal Committee, said: "Never for a single moment had the private friendship existing between himself and Mr. Jenkins been interfered with by any friction in their business relations, and he yielded to no man in his appreciation of all that had during many years been done by Mr. Jenkins for the promotion of the best interests of the Society. He was most anxious that every care should be taken to render full justice to the memory of their late Secretary. Having said this much, he did not for an instant doubt that the Society could go on as heretofore. When a good man fell in the ranks —and undoubtedly a good man had fallen—it was the duty of the survivors to close up, and push on. The steady onward march of this great Society should not, and must not, be impeded."

VII.—*Tobacco as a Farm Crop for England.* By C. DE L. FAUNCE DE LAUNE, of Sharsted Court, Sittingbourne.

THE last work of the late Mr. Jenkins was an article in the Royal Agricultural Society's 'Journal,' * on the Cultivation of Tobacco in the North-West of Europe. A melancholy interest naturally attaches itself to this article, and when, by request, I took up the subject where he left off, I realized more fully than ever the loss that this Society and myself had sustained.

I cannot hope, nor do I even attempt to treat the subject exhaustively, as such an endeavour would occupy all the limits of this Journal; all I can hope for, and all I aim at accomplishing, is to collect the most trustworthy information on the leading points of the tobacco question, to lay before my readers

* Vol. xxii., 1886, p. 729 *et seq.*

the scientific and commercial details, and to epitomize my own experiences, so as to lay a safe foundation for others to work upon.

I found it impossible to give the public an adequate impression of the importance of the subject, without entering closely into the question of revenue. I also further found that even the earliest principles that must guide us to the successful cultivation of this delicate plant required a certain knowledge of the abstruse questions of chemistry and botany. I have, therefore, endeavoured to collect all the information I could in the limited time at my disposal, leaving to others, more capable than myself, to carry on the subject, each in his own particular province.

Together with my own remarks, I have incorporated Mr. A. Wingham's analyses of tobacco grown by Lord Harris, Mr. W. L. Wigan, and myself; and Mr. Wigan's description of his own experiment in tobacco-growing at East Malling, which they have kindly given me permission to publish.

It will be obvious to those who read this article that many great and important interests in this country are connected with the cultivation and sale of tobacco; and although it is of paramount importance at the present moment to increase the profitable employment of labour in this country, these vested interests deserve mature consideration before being interfered with.

A list of books and pamphlets treating of tobacco will be found appended to this paper, to which any readers of this article who desire further information on this head may refer; and the comments I have made on some of these books may possibly guide their research.

As soon as it was generally known that tobacco was about to be cultivated in England, and during the growing, harvesting and drying of my crop, numerous questions were put to me, some displaying curious ignorance, and others so pertinent that they led me to the idea of reproducing them in the form in which they were asked, and in which the answers were given to them. The form of dialogue, though backed by very high and ancient authority, is not usually favoured in scientific or agricultural literature; but I have adopted it on this occasion, seeing that the subject of tobacco culture in England is not confined to the agricultural community alone, but possesses an interest for many to whom a long string of agricultural and scientific details would be tedious, and which the system of question and answer may tend to simplify. This mode of treating the subject is not entirely unprecedented in the 'Journal,' for the questions in the last number * which drew

* Vol. xxii., 1886, p. 377 *et seq.* (H. F. Moore.—"The Winter of 1885-6").

such clear answers respecting the effects of the winter of 1885–1886, must have shown to many the value of this method as a vehicle of information.

Question.—What made you think of tobacco as an English crop?

Answer.—In 1884 I was travelling in America, and a farmer in Massachusetts told me that it was the only crop from which he derived any profit, and the conditions of the soil and climate in that district reminded me forcibly of Kent.

Q.—What induced you to advocate the cultivation of tobacco here? Your object could hardly have been profit or pure philanthropy?

A.—After my return to England I investigated the subject, and found from Lobel's 'Novum Stirpium Adversaria,' printed in London in 1570, that tobacco, which had been introduced into England anterior to that time (not, as popularly supposed, in 1586 by Sir Walter Raleigh), was then successfully cultivated in England and Scotland, and flourished until fines, each heavier than the last, and ultimately amounting to 1600*l.* per acre for the grower, with a special fine to be levied on magistrates for not informing, put an end to its cultivation in Great Britain.

The second part of the question is more difficult to answer. Possibly both the reasons you suggest induced me to turn my attention to tobacco. But it was evident to me that the pioneers of a crop requiring such knowledge and skill, even if they succeeded in establishing it without aid from the Government, must inevitably be considerable losers. I am convinced, however, that, in the present extraordinary agricultural depression, all crops should at least be attempted which present a chance of becoming profitable, and especially all such as would provide remunerative employment and increase the intelligence of the labourer and his family.

Q.—Are you then prepared to expend your time and money for the purpose of securing employment for the agricultural labourer?

A.—Certainly; but not with this object alone, for I am fully convinced that where agricultural labour is profitably employed, the produce and value of the land and the amount of labour required on it increase *pro ratâ;* and further, that where the labour is employed in the production of luxuries now imported from foreign lands, there is a real gain to the country at large.

Q.—I gather that you are of opinion that the increased cultivation of crops that employ a large quantity of profitable labour indirectly affects all property?

A.—Exactly so; the working-population are the principal

customers of the farmer, for they buy his produce, and, in fact, contribute to the general prosperity. And since such is the case, it seems strange that these labour-demanding and profitable crops are not fostered in England; yet there is no indication in the English Government Reports of any intention to foster them, though, if we turn to the agricultural reports of the United States Government, we shall see that a keen desire to do this is very distinctly entertained on the other side of the Atlantic. The American Commissioners consider that tobacco culture, perhaps more conspicuously than any other kind of farming, exhibits the condition of agricultural progress in the regions in which the staple is produced. They are of opinion that progressive enterprise in tobacco growing has had most beneficial effects upon other agricultural pursuits; since, wherever tobacco culture has been made profitable, there has been an increase of all farm products suited to the locality. This statement has been corroborated by a gentleman who lived in North Carolina for many years, and who informed me that, previous to the introduction of the tobacco crop, many of the small farmers lived from hand to mouth, and some were in poverty. Tobacco has given them the means of buying better agricultural implements, hence a great improvement in their farm produce.

Q.—I understand, then, that for these reasons you are prepared to press on the notice of the public the cultivation of tobacco, in opposition to popular opinion as expressed in the 'Times,' * in which the lack of technical skill in the agricultural labourer was urged as one of its most formidable impediments, on the ground that "it would take a generation to train English labourers to the habits of careful and exact culture required to cope with all these demands."

A.—I am so far from considering that remark in the light of an argument against our culture of tobacco, that I welcome it as a strong one in its favour, and I cannot help thinking that its culture is likely to improve the technical education and intelligence of the people.

Q.—Are you of opinion that last year's restrictions on tobacco-growing ought to be continued?

A.—Certainly not. If tobacco is to have a fair trial, more liberal arrangements ought to be conceded by the Government, more especially as during the last two hundred years the prohibitive duty on English tobacco growers has amounted to 32*s.* a pound; so that, during the above period, while American growers have been paying a duty of about 3*s.* 6*d.* a pound,

* April 29th, 1886.

any person growing tobacco in this country would have to pay a duty of 32*s.* per lb. English growers would, no doubt, successfully grow tobacco under the same privileges that the Virginian growers have enjoyed for the past two hundred years.

At the present moment a duty of 3*s.* 6*d.* per lb. is charged on all unmanufactured tobacco containing not more than 10 per cent. of moisture, and on that with a less percentage, 3*s.* 10*d.* Manufactured tobacco also pays a different duty; cigars paying 5*s.* 6*d.* per lb., and Negrohead, 4*s.* 10*d.* per lb.

The question of moisture is important, as it concerns the "drinking-power" of tobacco, on which the market value of common tobacco very much depends, as is demonstrated by the fact that tobacco is sold by manufacturers under 3*s.* 6*d.* a lb., a sum less than the duty imposed on it. I sent some of my dark and light tobacco to Dr. Voelcker to determine its "drinking-power," and he found that one pound of the dark leaves, according to Moore's method, was capable of absorbing 2·5 lbs. of water, and that one pound of the light tobacco absorbed 1·9 lbs. of water. From this it must not be inferred that tobacconists use so much water with their tobacco, but rather that the power of absorption of a leaf is a guide to the amount of water that may be mixed with it.

In exacting the tax on tobacco, to recognize only one quality is an easy and inexpensive, though somewhat rough-and-ready way of raising a great revenue; but although considered good for the revenue, it is hardly fair to the consumer of inferior tobaccos, since the smoker of unmanufactured tobacco, valued at 4*d.* a pound, has to pay the same duty as he who can afford to purchase that valued at 6*s.* If tobacco culture gains ground in England, it would be a means of supplying the labouring population with a cheaper and purer tobacco. You would naturally suggest levying a duty according to the value of the tobacco; but the difficulties that immediately present themselves in this, or any other mode of exacting a duty according to grade, are so numerous, as to be an additional reason for allowing ample time for consideration to the Government, and for regarding this question of tobacco for the present as entirely in the experimental stage.

Q.—You do not then suggest an *ad valorem* duty, which would smooth all difficulties?

A.—Not at present; for to suggest any means of entirely overcoming the difficulties that naturally present themselves would require a far greater knowledge than I possess. The difficulties in the way are great, and the first one is that of the increased cost in the collection of the revenue. As I said, all unmanufactured tobacco pays the same duty, whatever its

quality—good, bad or indifferent. If, however, an *ad valorem* duty were imposed, a much larger staff of analysts would be required for the purpose of grading the imported tobaccos. At the present moment, the best and richest leaf, viz., that which contains the most natural gum, pays no more duty than a poor leaf adulterated with gum and gelatine.

The adulterants in tobacco are endless; dock-leaves, paper, lampblack, saltpetre, alum, sand, sulphate of iron, wheat-flour, glycerine, logwood, thorn-apple-leaves, plane-leaves, and rhubarb, being all freely used for purposes of adulteration. Cabbage-leaves were formerly used, but are not now so generally used. Whatever alterations in the imposition of the revenue may eventually be made, it is obvious that they ought to be made only after very mature considerations on the part of the Government.

Q.—What then, after due consideration, do you think the Government should do?

A.—After frequent conversations with the Revenue officials who have visited my tobacco crop, and after reviewing the suggestions that have been made to me, I am led to believe that the easiest course for both the cultivator and the Government is that the Government should—

(i.) Absolutely forbid the growth of tobacco without a license, even to the extent of a single plant in a garden.

(ii.) Grant licenses to grow tobacco on not less than half an acre and on not more than five acres, on payment of a fixed sum, in lieu of duty, per acre, for a period of five or seven years; the period for application for licenses to be limited, so that only those who seriously intend to undertake this culture should have an inducement to apply for them.

By these restrictions the trouble and expense to the Revenue Department in making the necessary observations and collecting details regarding the growth of this plant in the counties where the experiments were carried on would be minimised, and experimenters would have some chance of not being altogether losers.

Q.—Why do you prefer to exact the duty by the acre rather than by the pound, as in the case of imported tobacco? for any interference with a department of the Revenue that brings in no less than 9,000,000*l.* per annum must be backed by very weighty reasons.

A.—Of this I am fully aware; but I must explain that I am in no way suggesting a permanent alteration in the collection of the tobacco duty, but only concessions which the Government should make to facilitate the experimental cultivation of tobacco. It would be for the Government to report on these experiments

and to draw their own conclusions with regard to the future. If it were proved that tobacco could not be grown, the matter would there end; if it were proved that tobacco could only be grown profitably in consequence of the alteration of the present laws, it would be for the country to decide whether those alterations should be made.

It must be evident how necessary it is that these experiments should be carried out on a scale large enough to enable the Government to arrive at a true decision, seeing there is in the balance 9,000,000*l.* per annum on one side and a good trade on the other.

It is for these reasons, therefore, that I suggested the limitation in the number of experimenters, and the quantity of land to be experimented upon. I cannot express too strongly my conviction that, in its present stage, the cultivation of tobacco in this country should be looked on as an experiment, and as an experiment only. Nothing could be more injurious to the experiments, or could more discredit the growth of tobacco in this country, or add to the cost of a Government enquiry, than a large number of small, ill-conducted attempts to grow it. The large revenue that is derived from tobacco, and the great indirect advantage this country might derive from its cultivation ought to induce those who seriously wish to promote its growth not to hurry it prematurely forward, but to establish a firm foundation to work upon. I regret to find that some promoters are inclined to press forward its cultivation in this country at any cost, and it is one advantage of a society like the Royal Agricultural Society of England, that it is able, while aiding a great agricultural movement where millions are concerned, to judge dispassionately, and thus check any ill-advised promoters of this scheme from ultimately injuring the result we all wish to bring about by premature and precipitate advocacy.

Q.—You have shown that concessions ought to be made, from the experimenter's point of view, but what benefit is the public to derive from this disturbance of the Revenue?

A.—The public will be benefited indirectly through the advantages that would accrue to the agricultural interest. If you grant that it is well for the Government to allow experiments, a payment of a duty per acre in lieu of a duty per pound will be a direct encouragement to the experimenter to grow as much tobacco as possible to the acre, and (which is much more important) to insist upon good and careful work from the men, women and children that he employs, to whom he could consequently give higher wages, and who would actually receive an education from the careful cultivation of a plant so delicate and so valuable, seeing that a single plant

might be worth from 1*s.* 3*d.* to 2*s.*, and each leaf 1½*d.* or 2*d.*; for with regard to the important question of technical education, it is high time we attempted to regain our position as a commercial power, which we have undeniably lost of late years through our manifest inferiority to other countries on this very head. Surely, then, it is not too much to ask a Government which spends so much in national education, and which is on the point of being asked to expend a still larger sum on national scientific education, to aid an experiment towards the production of a crop which, if successful, will go far to provide the agricultural community with remunerative labour, and also, as we gather from the United States Reports, will contribute largely to their education and intelligence—all without any direct monetary grant from the Government.

Q.—Do you expect tobacco will take the place of wheat in England?

A.—No; but it may in conjunction with other crops become a great boon, not only to the agricultural community, but also to the whole population of workers—men, women and children, in the towns where it is manufactured.

Wheat can be grown in this country, but it cannot be grown profitably at the present price, though English wheat is often equal to foreign; and I am in a position to state that India alone, without any help from America, is able to supply all the wheat we now consume. We have arrived at the knowledge that wheat cannot be grown here at a profit, which is also, I am afraid, equally applicable to much of our agricultural produce, except in a few specially favoured districts. The same conclusion may eventually be forced upon us with regard to tobacco, though such a result is not yet proved; and I consider the profit at the commencement of the attempt only secondary to testing whether or not tobacco can be successfully grown.

Q.—But surely the question of profit is the real question?

A.—No doubt it will eventually be when tobacco comes to be regularly cultivated, but it is not now the first to be proved. Hence it is necessary to prove that we can grow tobacco of a certain quality, before we can enter upon the question of its profitable growth.

Q.—Why should not the question of profit be first proved?

A.—Because it has been denied that tobacco can be grown in England, and it was necessary to test that statement, before the question of profit could be entered into.

Q.—Was not the late Mr. Jenkins of opinion that tobacco could not be brought to maturity in England from want of sun?

A.—Yes, and many others held the same opinion. Mr. Jenkins had considered the question thoroughly from his

knowledge of the cultivation of tobacco in Europe, but my observations in America led me to an opposite conclusion.

Q.—Is it not generally allowed now that tobacco can be grown here?

A.—Yes.

Q.—What, then, is the difficulty now in the way?

A.—The opponents of the cultivation of tobacco in England have somewhat shifted their ground, and now it is said that it cannot be cured, and even when cured it will not be worth smoking. In reply, I can only say that our attempts at curing have been more successful than I anticipated, and although the required point of time has not yet arrived when we can judge of the flavour, we are assured of the colour and combustibility; as to the quality, I have the best authority to state that my Kentucky is worth 4½*d.* or 5*d.* a pound; in other words, that it is equal to very useful dark Kentucky produced in America, fit for wrappers. And if the crop can be grown to pay, yet another advantage ensues in the question of manure, in which the tobacco crop is extravagant; for the agricultural desideratum in England at the present time is a crop that requires a large quantity of manure, and will pay for it, for stock can thereby be kept at a lower price.

Q.—I do not quite follow you that tobacco is a useful crop to the farmer on account of its requiring a large quantity of manure. For surely the exhausting nature of this crop is one of the main arguments brought against it?

A.—It is a strong argument against English tobacco-growing so long as the crop does not pay; but if the crop can be made to pay for the manure it requires, then it becomes one of the strongest arguments in its favour. A farmer growing tobacco would include in the expenses of his crop a certain amount of money for manure per acre, and therefore this manure would have either to be bought or made, and if made by the farmer, the value of the manure would be deducted from the cost of fattening animals; in plain language, the manurial value of the feeding-stuffs would be sold by the farmer to himself for his tobacco crop. This is already exemplified in Kent, in the cherry orchards, by the following analogous case. Mr. George Webb, agent to an estate where there are large cherry orchards, the fruit belonging to the landlord, and not to the tenant, allows the tenant renting the grass under the cherry-trees 15 per cent. of the value of the root-crops, one-third of the linseed-, or cotton-cake, one-fourth of the corn, or maize, one-sixth of the bran, pollard, or grains that are fed in the orchards, since he considers that the cherries are a sufficiently profitable crop to pay for the manurial value to his land thus obtained. Wheat used to pay for manure

put on the land, and for one, and sometimes two crops afterwards; such is no longer the case; therefore less meat will be produced in England than formerly, unless the rise in the price of meat is proportionate to the fall in wheat.

Q.—I understand you to say that India is likely to become a successful bidder for the corn supply of England. We see also, by the admirable Reports of Dr. Forbes Watson, and of Mr. J. E. O'Connor, on Tobacco Growing in India,* that the growth of tobacco has also been commenced in that country. Were these reports compiled by private individuals, or by the Indian Government?

A.—The Indian Report is compiled from instructions given by the Secretary to the Government of India for the Department of Agriculture, Revenue and Commerce, and treats scientifically of the growth of tobacco over the whole world. It is almost as exhaustive as the report on tobacco in the United States Statistics for Agriculture (1880), which is so voluminous that it occupies no less than 370 folio pages; but I have considered it valuable rather as showing that Government assistance in the matter of tobacco growing would not be altogether without precedent, than to show how it can be cultivated or cured.

Q.—What varieties of tobacco did you plant?

A.—When permission to grow tobacco was eventually obtained from the Government, I procured from Messrs. James Carter and Co. plants of the following varieties of tobacco:—Hester Virginia, Kentucky, Connecticut, Cain's Seed Leaf, Maryland Broad Leaf, Big Frederick, One Sucker, Florida, Glasner, Island Broad Leaf, and Macrophylla.

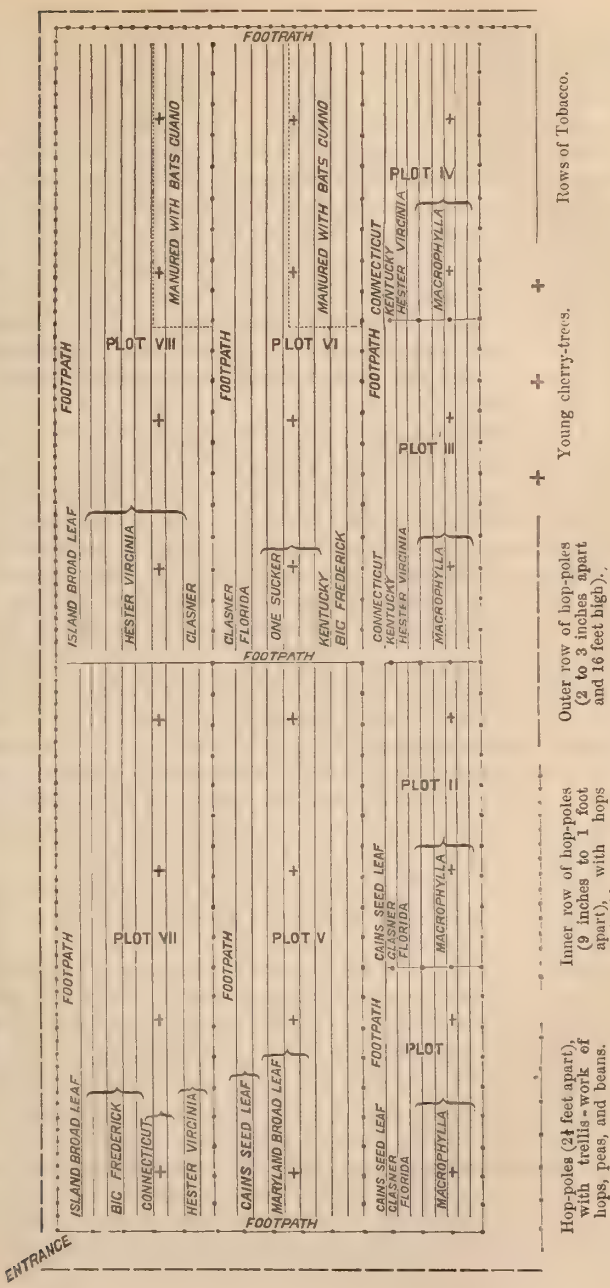
Q.—You manured the land differently, did you not?

A.—Yes; the piece of land on which the tobacco was grown was in good heart and was divided into several portions, each being manured differently.

The half acre of land (see plan on page 223) in which I selected to plant the tobacco had previously been a hop-garden, and had been manured by sheep fed on turnips the previous autumn. This rectangular plot of land was surrounded by double lines of hop-poles, the outside poles being 16 feet high, and 2 to 3 inches apart; and the inner ones, 12 feet high, and 9 inches to 1 foot apart. The distance between the rows was 3 feet, and between the inner poles hops were trained up, which, together with thatched hurdles, afforded an almost perfect shelter from wind, and raised the temperature to a high degree. The half acre was divided into eight plots, separated by rows of hop-poles intertwined with hops as before.

* Vide page 251 of this article.

Plan of the Half Acre of Land in which the several varieties of Tobacco were planted.



About the end of March the soil was manured with stable manure, bats' guano, wood ashes, and sheep's dung. In Virginia and North Carolina the land is usually ploughed deep in the autumn, some farm manure being worked in if possible. Wheat straw is considered very good, but guano or much farmyard manure is not popular. The land having been re-dug and completely pulverised, the plants, which had been raised in pans under glass and then transplanted into a hot-bed, were inserted. In most cases they were placed in ridges from 3 to $3\frac{1}{2}$ feet apart, the distance between each plant being 3 feet. In a few instances the young plants were placed on the flat with a trowel. At the time of planting the young plants were about an inch high, with four leaves showing. There was a continuance of dry weather, and the plants were watered three times in the next three weeks.

On July 17th the land round the plants was hoed, and one plot was manured with bats' guano and decorticated cotton-cake.

The plants grew very fast, the average growth being about $\frac{3}{4}$-inch per diem, until they reached a height varying from 3 to 4 feet, when the heads were cut off. Each plant had now 9 or 10 leaves only, and these continued growing until the first week in September, at which period they varied in length from 20 inches to 49 inches, and in breadth from 10 inches to 25 inches. A few plants, and among them two of the Kentucky variety, were not decapitated, being left to flower as specimens; subsequently, however, when the idea of saving seed from the Kentucky plants occurred to me, I broke off the blossoms from all the other plants to prevent inoculation. As a protection against frost I covered these two plants with matting (a precaution afterwards found to be unnecessary), and they fully ripened their seed.

I found that the distance between each plant was not great enough, for, when the tobacco grew up, there was much difficulty in removing the suckers.

Suckers appeared on July 20th at the junction of the leaf with the stem, and I thought by removing them weekly I should be able to keep them down, and so prevent them from sapping the strength of the plant. I found, however, I was greatly mistaken, and the suckers defied all our efforts to remove them without injury to the leaf. They grow with far greater rapidity here than in America (where, I am told, it is only necessary to remove suckers once a week), and they finally attained a length of 5 feet. One measured during September had an average daily growth of $\frac{3}{4}$-inch, and on some days grew as much as $1\frac{3}{4}$ inches. The circumference at the junction with the stem was $1\frac{3}{4}$ inches. I frequently removed them myself, and I found my clothes were

covered with a sticky substance, and my hands became quite black, and even my watch-chain had to be washed after contact with the leaves. The best time for removing the suckers with least injury to the leaves seemed to be before sunrise, as I discovered on removing the suckers very early one morning in August, for the moment the sun struck the leaves, they cracked, if touched, in all directions. The continuous removal of these suckers is most essential to the welfare of the plant, since, if left, they were found to increase at the rate of ¾-inch a day, and thus were a continual drain on the strength of the plant. I have no hesitation in saying that many of the leaves lost in quality and substance owing to the action of the suckers, and, consequently, in the drying process cured "papery."

Q.—Were the plants infested with worms or insects?

A.—Worms, which cause such trouble in America, did not appear here; and the only insects that gave us any trouble were earwigs, and, in order to ascertain whether these insects were really perforating the leaves, I consulted Miss Ormerod, and put a tobacco-leaf into a bottle together with some earwigs. The result was decisive, as the insects devoured nearly the whole leaf.

Q.—Was not the season remarkably favourable to the cultivation of tobacco?

A.—It has generally been considered so by most people, but I myself am by no means inclined to regard it as the perfection of tobacco weather—the earlier part of the season being ungenial and cold, and the latter part extremely hot, so that the tobacco was forced into growth at the very time when it ought to have been maturing, and the weather was so dry that the rainfall was only 5 inches from planting to harvesting.

Q.—When did you commence your tobacco harvest?

A.—The Kentucky and Connecticut plants showed the first signs of ripening, and the harvesting was carried on from September 3rd till the 18th of October. Various methods of getting in the crop, described in the United States Government Agricultural Report, were adopted. In some cases individual leaves were cut off; in others the entire plant was cut down close to the ground; and thirdly, and best of all, the stem was split nearly to the bottom and the plants slung on lathes about 5 feet long; these in turn being arranged on a square frame-work on wheels and conveyed to the hop-oast, which was to serve as the drying-room. All these processes are fully described, with accompanying illustrations, in the United States Report on the Productions of Agriculture (Washington, 1883).*

* *Vide* p. 251 of this article.

Q.—Did your use of manures in various kinds and quantities produce different results?

A.—Yes. I believe that the plot manured with bats' guano was least, and that manured with wood-ashes most successful.

Q.—Did you observe any marked difference in the times of ripening and in the colour of the various plants?

A.—The difference was very pronounced in the growth of yellow tobacco, sold under the name of "Kentucky." That manured with bats' guano was much greener and did not ripen nearly so fast as the other; and when it was dried, green spots showed on the leaves, and the tips were of a dull reddish-brown colour, instead of being bright yellow like the rest of the leaf.

The first intimation to me that the leaves of tobacco ever became absolutely yellow in a growing state was when I saw my own Kentucky plants turn yellow, while all the others remained green. The idea then occurred to me that I might fix the colour as described in the American reports. I had a very limited quantity of Kentucky, which was the only kind that turned decidedly yellow, some being planted in plot 4, some in plot 6, as you can see in the Plan (p. 223), the plots being separated by footpaths.

The difference between the Kentucky in these two plots was very marked. The Kentucky in plot 6 was treated in all ways similarly to plot 4, with the exception of the growing plants being manured with bats' guano; but while the Kentucky in plot 4 was yellow, that in plot 6 was green. Two plants left till October 13th in plot 6 were not as yellow as those in plot 4 on the same date in September.

This conclusively proved to me that tobacco may be over-manured. I am inclined to believe that my tobacco was generally over-manured, and particularly where bats' guano was applied (though, had that manure alone been applied, the result might have been successful); but I might not have discovered this important fact had it not been for the natural tendency of the so-called Kentucky tobacco to turn yellow, following its natural bent in plot 4, but thwarted by the application of manure in plot 6. We owe this discovery indirectly to Messrs. Carter & Co., who with praiseworthy energy sent over to America as soon as the subject of tobacco culture in England was broached, and secured every possible variety, including the above-mentioned Kentucky plants.

Q.—Do you mean me to infer then that, except in the case of yellow tobacco, you could not tell whether the plants were over-manured or not?

A.—In the other tobaccos I think I should have been led to suspect it, but I could not myself, and I doubt whether any one else could, have stated as a fact, judging from their appearance,

that they were over-manured. Yellow tobacco undeniably proved it, and this fact was subsequently detected in a chemical analysis. I thus arrived at facts which might have taken years to discover, had the yellow varieties not been grown.

Q.—I gather then that the discovery that yellow tobacco could be grown in England is of value?

A.—Yes; not only on account of the discovery made respecting manure, but because, if you refer to the trade reports in the 'Times,' in which tobacco is mentioned, you will see that it is only bright tobacco that keeps its price; and the demand for it in America is so great that some yellow tobacco, after being shipped here from America, has been re-exported. This variety, and the kind known as "Big Frederick," I consider to be the most suited to the English soil. Messrs. Carter & Co. are strongly of this opinion, and they are corroborated by Mr. Wingham's analysis.

Q.—You did not cut all your tobacco at the same time?

A.—Not all at the same time. This was of course a new departure in agriculture, and as we were trying to discover the best methods of cultivating and curing the tobacco, in order to ascertain what effect the weather had on that left standing, we cut it at intervals of every few days.

Q.—Could you not have cut and dried the tobacco at the same time with less expense?

A.—Certainly with less expense, but also with less experience.

Q.—You did not regard expense, then?

A.—That is hardly the case. I did not willingly incur unnecessary expense; but when I thought my object could be attained by an additional outlay of money or trouble, I never grudged it, since I wished to make the experiment as conclusive as possible. Mr. Wigan's expenses, amounting to a little under 20*l.* for half an acre, are a more correct guide to the cultivator than mine, which are entirely conjectural, but which could not have amounted to less than 60*l.* for the same extent of ground.

Q.—You are not quite certain as to your various experiments?

A.—The experiments were so numerous and complicated that during the time of growing, drying and stripping, it was extremely difficult to keep a strictly accurate record.

Q.—Have you any knowledge of the curing of tobacco in addition to what you gained from your own experience?

A.—I have gained information from the admirable report of the American Government, and from Mr. Jenkins's paper in the Royal Agricultural Society's 'Journal,' * on the cultivation and drying of tobacco on the Continent.

* Vol. xxii., 1886, p. 729 *et seq.*

Q.—What practical hints did you derive from those publications?

A.—I came to the conclusion that in England we ought to trust wholly to artificial drying, as it is carried on in America.

Q.—You consider, then, that drying is not so delicate an operation as to be materially affected by variations or quality of climate?

A.—Such is by no means my opinion; for inferiority of climate will necessarily increase the cost, and even with unlimited means at command it is always difficult to reproduce the wished-for climate artificially.

Q.—But you think it better to attempt to copy a good climate by artificial means than to depend on even a fair climate?

A.—The Americans, whose extensive experience in the curing of tobacco is known to every one, evidently think so; for though their climate is better adapted for drying than that of Europe, they are rapidly superseding sun-curing by a system of artificial drying.

Q.—I have been told that you dried your tobacco fairly well, and produced yellow, brown, and mottled tobacco of good colour. Did you not dry some tobacco green at first?

A.—Yes, the variety, the so-called Kentucky, which was naturally yellow, I dried yellow; some of the green varieties, unintentionally, I dried green; but others I treated so as to successfully produce the colours I wished. Kentucky tobacco is not yellow at home, but red-brown or cinnamon in colour.

Q.—Did you attempt to make all necessary observations yourself?

A.—No; my clerk, Mr. Rayfield, helped me in making observations; but I found the work was too much for us, and I accordingly applied to Mr. Wells, Chairman of the Chemical Committee of the Royal Agricultural Society, and to Dr. Voelcker, to send some one with a scientific training to help us; and, in accordance with my request, Dr. Leather, the able assistant at 12, Hanover Square, was sent down, and made some most valuable notes after the process of drying had begun.

Q.—It appears to me that the operation of curing tobacco is more difficult and laborious than would at first appear.

A.—The labour consists more in keeping the temperature at an exact height, even to 2° or 3°, which is necessary if you wish to follow more scientific modes of curing, such as are recorded in the American Reports. We kept two or three kilns continually at work from September 3rd to October 29th, records of the temperature being kept during the whole time.

Q.—I understand that the real difficulty with tobacco consists not so much in the growing as in the curing of the leaf?

A.—The art of curing, no doubt, is difficult, but not insuperable. I fully recognized the difficulties, hence my reason for asking for a trained scientific observer. The chief difficulty in acquiring a knowledge of tobacco-curing, or of any other process of a similar nature, is to make a true diagnosis. It is not only necessary to gain a result, but to know by what means that result has been gained. A result attained, though it be a wrong one, may be of the utmost value if the exact reason of its attainment be known. For example, drying my tobacco green was a wrong result, but it led to my being able to turn tobacco brown that had been by mistake dried green; and yet I was better able to arrive at the knowledge of the processes which have been aimed at in America for many years, and which are now, I believe, known only to a few. I do not feel assured that I should have arrived successfully at this issue, had I not availed myself of the assistance of Mr. J. Randolph Hamilton, Jun., whose combined knowledge of tobacco, both in its details as a crop in America and as an article of merchandize in England, is probably unsurpassed. In following the American method of tobacco-curing, which is purposely adapted to a dry climate, and in trying to make that method meet the exigencies of our humid climate, for which it was never intended, some difficulties naturally presented themselves. I tried to hang my tobacco in a dry room after it was cured, but one season's experience will justify me in saying that it will be impossible to trust to the varying conditions of our climate without artificial heat. Lord Walsingham appears to have overcome the difficulty by bulking, or putting the tobacco in a heap, and keeping the room up to a temperature of 70° F. by means of fires, and by covering the tobacco with sacks. This is contrary to the general practice in America, where the tobacco is hung till the spring, and then bulked.

Q.—Do you think that you were repaid for all this trouble?

A.—Certainly not pecuniarily. The whole of the tobacco might have been wilted for 8 or 10 days, and then dried in three kilns all at once in a week. There would have been only one-twentieth part of coal used, and only one-fifth part of the labour. But I wished to make the experiment as exhaustive as possible. Lord Walsingham, Mr. McCormick, Messrs. Carter & Co., and others, have shown how easily it can be done; and Mr. Bateman, by his unfortunate fire, has given timely warning to farmers to use the utmost care in the future.

Q.—I should like to see some tangible result for all this trouble and expense that you were put to.

A.—The result may seem at first thought hardly equal to the time and trouble expended upon it, but you will find great

stress laid on colour. The colour of tobacco is an important item, and is valuable as indicative of the quality of the tobacco, so far as bright Virginia or Carolina, Turkish or China tobaccos are concerned. It is now an accomplished fact, that tobacco of a lemon-yellow colour—that which commands the highest price in the market except cigar leaf—can be produced in England, the bare suggestion of which would have been scoffed at last year; and there seems to be no reason why results equally unlooked for may not be established by another year's experiments.

At present, all the causes that lead to quality in a tobacco-leaf are not well known, but I have no hesitation in saying that the curing has a great effect on its smoking qualities.

Q.—But surely climate and soil have more to do with the quality of tobacco than curing?

A.—Proper soil is, perhaps, the most indispensable factor in producing this delicate plant, but the knowledge of the art of regulating the three, and of supplying a deficiency where it occurs by artificial means, will be most likely to establish the growth of tobacco in this country.

Q.—Let us now consider the question of climate. How do you propose to remedy our deficiency in this respect?

A.—In my own experiment, while the plant was growing, I supplied heat and shelter, as far as possible, by erecting close rows of hop-poles. The profit of the hops trained up them cancelled their expense, and in other parts of the country peas and French beans might be used for a similar purpose. Mr. W. L. Wigan, who has written a very useful report on the cultivation of tobacco, used maize as a shelter.

Q.—And how did you try to remedy your inferiority of soil?

A.—This, of course, is an essential difficulty, and receives great attention from all writers on the subject of tobacco in Europe, Asia and America. On one point they all seem to agree, viz., to the indispensability of potash in the soil, which is found in considerable quantities in the land of the best tobacco districts; and analyses of soils and tobaccos grown on them under varying conditions of climate, latitude and hemisphere, demonstrate that the potash in the soils and the tobaccos is relatively kept, or approximately so.

In the report on the cultivation and preparation of tobacco in India by Mr. J. E. O'Connor,* the analysis of a soil that produces good tobacco in Maryland is quoted, and gives the amount of potash as 4·60 per cent., while an analysis of land adjoining the land where my tobacco was growing, made in 1882 by the late Dr. Voelcker, showed ·41 per cent. of potash. Sir John

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* *Vide* p. 251 of this article.

Lawes said, regarding this analysis, that my soil, though poor in potash for tobacco-growing, is not so for ordinary agriculture.

Mr. A. Wingham, of the Royal School of Mines, has kindly analysed some of the tobacco grown by Lord Harris, Mr. W. L. Wigan, and myself. Unfortunately, I was unable to obtain any analysis of that grown by Lord Walsingham. These analyses are curious, and are well worth the study of tobacco-planters and agriculturists in general. Sir John Lawes, after reading them, considered they fully demonstrated the value of the analysis of the ash of a plant as indicating the close connection between the composition of the manure and the ash of the crude green leaves of the plant. He advised sulphate of potash instead of kainit, if a manure was to be used, and suggested making experiments in this direction at once, calling my attention to the fact that ripe seeds differ very little, though different manures may have been applied ; yet the composition of green parts of plants is greatly influenced by the manure.

The scrutiny to which the tobacco-plant is subjected is very severe. No other plant is made to endure so crucial a test, since tobacco has not only to be tasted, but also to be smoked and smelt ; whereas, to satisfy one of these tests is all that is required of an ordinary plant. An excess of chlorine, for instance, would retard the combustion. Lord Harris's tobacco contained as much as 28·52 per cent., while Mr. Wigan's and my tobacco contained 9·15 and 9·63 per cent. respectively of chlorine. The excessive amount of chlorine in Lord Harris's tobacco is attributed by Sir John Lawes to the use of salt as a manure, a quantity equal to 8 cwt. an acre having been used.

By Mr. Wingham's analysis, Lord Harris's tobacco was found to contain 8·02 per cent. of potash, Mr. Wigan's, 11·32 per cent., and mine, 9·30 per cent. ; while tobacco grown in Maryland was found to contain no less than 40·12 of potash. In each of the three English samples, Mr. Wingham discovered about 40 per cent. of lime, *i.e.* nearly four times as much as was found in the Maryland tobacco.

Q.—Do you consider these analyses to be favourable or unfavourable to English growers?

A.—On the whole, perhaps, unfavourable. Still, when we consider that Lord Harris's tobacco contained three times as much of the objectionable chlorine as mine, it seems to indicate that a means may be found of overcoming our difficulties.

Q.—Do the Americans pay much attention to particular manures?

A.—Certainly. They consider the use of proper manures as absolutely essential, and a fertilizer (as the Americans call manure) known as the "Anchor Brand," and sold by the

Southern Fertilizing Co., has a great reputation for aiding the growth of bright tobacco, as it is supposed to hasten the growth of the plant and bring it to maturity quickly —the very effect which my mode of manuring retarded instead of advancing.

Q.—Is the chemical analysis any guide to a purchaser of tobacco?

A.—No. The value depends too much on the flavour and aroma; but though not a guide to the purchaser, it is a very valuable guide to the grower. Scientific cultivation of tobacco is yet in its infancy—a statement which is applicable to all scientific agriculture, and generally recognized by Sir John Lawes, Dr. Gilbert and others. So fully aware of this was Sir John Lawes, that with magnificent munificence he has arranged that his experiments should be carried on for perpetuity.

Q.—Does Sir John Lawes think that tobacco will ever be successfully grown in England?

A.—I am afraid not; for though he is very willing to give aid, he does not hold out hopes that the British farmer will be able to compete with the foreigner, and his opinion confirms my idea, that it would now be premature to advise farmers to undertake the cultivation of tobacco who are not prepared to lay out money on experiments; though on the other hand, Mr. Wigan's balance-sheet shows that he has grown tobacco so inexpensively as to appear to bring it within the compass of an ordinary farmer.

When the Government of India wished to introduce into that country the cultivation of cinchona, they secured the best aid the Western science of the day could afford. Lord Walsingham, Lord Harris, Sir Edward Birkbeck, Mr. Bateman, Messrs. Carter & Co., myself and others are now attempting to do for tobacco in England what the Government of India did for cinchona.

Again, when the Indian Government wished to bring reay grass into profitable use they offered a splendid prize to any one who would enable them to do so. Messrs. Wills and others, in offering prizes to the most successful growers of tobacco in this country, are acting in a similar manner, and are aiding English industries in the same way that those of India were furthered.

Q.—You mentioned just now a hop-oast in which you dried your tobacco. What made you select that for use?

A.—Because it more nearly resembled a tobacco-drying barn than any other building I possessed. In addition to which, as it was already insured against fire, I had no trouble with insurance offices: a very important addition, seeing that Messrs. Carter & Co.'s crop was nearly spoiled owing to their

delay in arranging with the fire insurance office. Those who remember the total destruction of Mr. Bateman's crop by fire will see how necessary it is to provide against it.

My hop-oast is a large barn 99 feet by 18 feet, with a floor raised 7½ feet above the ground, and a thatched roof. Three kilns are built on to it; two of them square, 16 feet by 16 feet, and one round; these kilns being very similar to malt kilns. The tobacco was hung in tiers 15 feet above the fire, which was of anthracite coal, such as is used for hop-drying. Between the fire and the tobacco, and close under the latter, was a hair-cloth which distributed the heat more evenly, and likewise arrested the dust from the fire. We closely followed the directions given in the American Reports as concerning drying, using a far greater degree of heat than any other tobacco growers in England, raising the temperature as high as 190°, whereas the maximum temperature of Lord Walsingham and Messrs. Carter & Co. was 90°.

Mr. L. McCormick, in his Report furnished to Beale's "English Tobacco Culture,"* mentions that his temperature never exceeded 80°, which he considers a correct maximum heat, since he found that those plants which were at first subjected to a high degree of heat (at first) dried green, whereas those dried gradually assumed a light brown colour.

This statement, in which we all coincide, is interesting, because on it hangs the whole process of fixing the colour; for to fix the colour, and to fix it at the right time, is doubtless one of the great arts of drying tobacco; and, curiously enough, of all the numerous visitors to my tobacco who professed a knowledge of tobacco-curing, only one of the number, Mr. J. R. Hamilton, seemed to be acquainted with the art of fixing the colour.

Mr. W. L. Wigan's experiments in this direction are interesting and instructive. He does not see the value of raising the temperature to 170° F., thinking that such an extreme degree of heat is only used to dry the stalk. I myself think that very little is known about the effect of these high temperatures on tobacco, and from the information I have derived from Mr. Wigan, I am led to believe that upon this point further knowledge is required.

Q.—I conclude you have already smoked some of your tobacco.

A.—Yes, I had some of the leaves made into cigarettes by Messrs. Cope & Co., who kindly supplied me with much information about the manufacture of tobacco, and I sent them

* *Vide* p. 252 of this article.

to many people to be tasted. Among others, Lord Crawford and Balcarres said that out of the thirteen sorts some were mild and pleasant, but in all there was a peculiar flavour quite different to what one looks for in tobacco, and his impression was that it would be some time before they would be used, as the flavour needed an acquired taste. The Jibeli tobaccos from near Smyrna are quite out of the market in England, though largely used by all poor Arabs. There is a great similarity in the darker qualities of the Kent tobacco to the Jibeli sort. He said he used the Jibeli tobacco largely, when abroad, mixed with one third of Salonique. This makes a most pleasant smoke—the best of all to Lord Crawford's taste. Dr. Voelcker determined by analysis that the light tobacco contained 3·62 per cent. and the dark 2·41 per cent of nicotine. Although this assured me of a certain amount of success, it is not really a true test, for it is hardly fair to judge of the quality of the tobacco yet, as there are certain disagreeable organic substances in the leaf that can only be got rid of by fermentation.

Again, I believe that no variety of tobacco is manufactured alone, various tobaccos being always blended (by the manufacturer) for smoking. I had some very expensive American tobacco made into cigarettes without blending, in precisely the same way as the English tobacco, and they were not considered so good as the English.

Q.—What is indicated by the terms, "birds-eye," "honeydew," "cavendish" and the like? Are they merely technical terms, or do they denote any special variety?

A.—Tobaccos are classed into upwards of thirty different kinds, as Virginia, Maryland, China, German, Latakia, Sumatra, Trademonde and Paraguay; but all such specific designations are lost when tobacco is manufactured, and the terms you mention merely indicate a peculiarity in the mode of blending or of manufacture.

As a rule tobaccos are classed under five heads, namely "common," "middling," "good," "fine," and "selected." All these tobaccos when once passed into the hands of the manufacturers are manipulated and blended and are known under particular brands, such as Cope's "Prairie Flower," "Sultan Cigarettes," and English tobacco might possibly be used for purposes of blending, in the same way as China tobacco, which is a light, mild, and somewhat flavourless tobacco. The qualities which Lord Crawford mentions may give a value of their own, even if the flavour is not so good as to create a taste for English-grown tobacco.

Experiments in Growing and Curing Tobacco in the Parish of East Malling, Kent.

By Mr. W. L. Wigan.

Preliminary Remarks.—My crop was grown under some disadvantages, owing to my being late in learning that permission was to be given for the experiment to be made.

I had no land vacant, and no plants ready at the proper time.

I am inclined to think, however, that as an experiment my attempt will be none the less valuable; for my late-planted crop shows the ample margin there is in an English summer for the maturing of the plant.

Land set apart.—As I had no land uncropped, I set apart something more than ¼-acre in a fruit plantation—and measured another ¼-acre in a field of green rye just fed off by ewes and lambs.

The soil of the plantation was light and gravelly, with a subsoil of gravel, that of the field a sandy loam on sand—and both were due for a good dressing of manure.

The fruit-trees in the plantation were apple and raspberry, the former at irregular distances, the latter planted 3 feet × 4 feet.

The tobacco was planted between the rows. Many plants were overhung by the apples, and grew none the worse for the shade, though some leaves were damaged by the falling fruit.

Varieties of Tobacco planted.—Most of my plants were raised for me from Virginian seed supplied by Messrs. Carter & Co., and others from seed said to have been grown for many years in England. I have not been able to ascertain the name of this sort. Messrs. Little & Ballantyne, seedsmen, of Carlisle, sent me specimens of several varieties, but the long journey and the very dry weather were too much for most of them; and only those labelled "Latakia" and "Maryland" flourished.

I had also sent me a few plants grown by a friend in his garden for several years, which, from their resemblance to the plants of that name grown by Mr. De Laune, I take to be Pennsylvanians.

Preparation of Land.—The only preparation made in the plantation was to dig holes about 12 in. sq. by 15 in. deep, to mix a small quantity of short dung (some 2 loads to the ¼-acre), with the earth taken out, and to refill the holes with the mixture. The plants were dibbled into the centres of these cultivated squares.

Manures.—The field had a dressing of 6½ loads to the ¼-acre, in addition to the green rye fed on by ewes and lambs with cake, and was then ploughed and subsoiled on May 4th, and nidgetted on June 19th.

Planting.—My first lot of plants were ready on June 17th, and were put out in the plantation on the evenings of that day and the next. Planting was not finished till the 14th of July.

Watering.—The weather was very dry in June, and the plants were tender, and they had to be watered continually.

Soot.—A ring of soot was sown round each plant to protect it from slugs.

Wood-ashes.—Wood-ashes were applied round each plant on July 20th and 24th.

Priming, Earthing, Topping, and Suckering.—Began to prime, to earth up, and to top and sucker, on August 9th.

I began by leaving as many as 14 leaves, but soon reduced the number left, and grew finer leaves in consequence.

Number of Plants.—On August 28th I had living,—

1707	plants of Carter & Co.'s "Virginian."
432	„ „ English-grown.
19	resembling Pennsylvanian.
6	said to be Maryland.
7	„ Latakia.
4	unknown.
2175	

Cultivation.—Weeds were kept under by hand-hoeing.

Topping finished.—Topping was finished on September 4th. I left only 6 leaves on the latest plants.

Cutting.—Cutting began on September 6th, and ended on September 22nd.

Suckering.—Suckering continued till cutting was nearly finished.

Carrying.—In cutting and carrying, the stems were slit, and the plants slung on sticks, and carried head downwards.

Shelter.—The plantation was sheltered by hedges on every side, the field by a hedge on the north, and a crop of maize on the south, while sheep-gates on end afforded some shelter from the east and west.

I found the maize a most useful protection, because it grew as the tobacco did.

Curing (preparations for).—I began curing directly after cutting, on September 6th. A hop-kiln, which had not been used for hops for several years, was prepared by substituting for the cowl a square ventilator, with louvre boards which could be opened and shut at will to any point of the compass, and scaffolds were fixed to support in three tiers the sticks with the tobacco-plants hanging to them.

Curing-fuel.—The fuel used was charcoal, which was burnt on the floor. A sheet of iron was hung over the fire to save the plants hanging immediately above it from being scorched.

First Curing.—In my first curing, I followed the directions for curing a bright yellow given in a pamphlet of Messrs. Carter & Co., of which the following is the outline:—

1. Yellowing process, 90°	24 to 30 hours.
2. Fixing colour, 100°–120°	16 to 20 „
3. Curing leaf, 120°–125°	6 to 8 „
4. Curing stalk and stem, 125°–170°	9 „

except that I continued the yellowing process longer—up to 57 hours—because after 30 the leaves had changed so little. This, however, was not nearly enough, and the next process, that of fixing, was so successful that the greater part of that curing was fixed a permanent green.

It was very difficult to maintain a temperature of 170°, and quite unnecessary, it appears to me, for I cannot see the object of drying the stalk.

Second Curing.—In my second curing, begun on September 15th, I "yellowed" for 101 hours, and did not keep the fire going so regularly at night, so that the temperature fell at one time as low as 65°. I "fixed" for 17 hours, and cured for 15 hours, never going higher than 125°.

This curing was more successful than the first, and I obtained more bright yellow leaves; but it seems to me that with Virginian tobacco it can hardly be possible to cure a whole kiln-full bright yellow, unless the leaves were separated from the stalks, and taken to a separate fixing room as they were

ready; because some leaves change so much more quickly than others, and turn from yellow to brown while the later ones are waited for.

I did not proceed to cure the stems this time.

Later Curings.—My third and fourth curings began on September 21st and 22nd, but the whole of the tobacco hung in a granary without a fire till the 24th, when as much as there was room for was removed to the kiln, and the temperature was raised to between 80° and 90°.

Third Curing.—The kiln was kept at this heat for about a week, the fire being let down every night. At the end of that time most of the leaves had changed through yellow to a good brown. I had determined not to try for yellow.

As I had noticed in the earlier curings that some of the leaves dried before they had time to yellow, I stood tubs of water on the floor of the kiln, and had water boiling on the fire. As some leaves still seemed to dry too quickly, I let the fire out, and had the ventilator opened every fine day, and closed at night.

On October 12th most of the leaves were a good, but rather dark brown. On the 11th I had noticed mould on some of the stalks, and on the 12th a little on the stem of a leaf, so I had a small fire lighted in the evening, and again on the 14th and the same on nearly every day to the end of the month.

Fourth Curing.—The tobacco which was left hanging without a fire [after being cut on September 21st and 22nd] I will call my fourth curing. On October 12th, I noticed that the leaves were yellowing and browning satisfactorily. Nothing had been done to them since they were hung.

On November 3rd, I found mould not only on the stalks, but on some of the leaves, and as I saw signs on the stalks of the first two curings that mould was likely to follow if they were left unfired in that cold, damp weather, I had the whole crowded into the kiln, and thoroughly dried, at a temperature of about 90°. Since then I have had a fire lighted, and temperature raised to 90° whenever the leaves become very soft, which has been according to weather, about once a week, or once a fortnight.

Stripping and Sorting.—In December I stripped and sorted a part of my crop, and having made it into hands, hung it again in the kiln. I have not been able to do anything to it since then, beyond having the fire lighted when necessary.

Remarks.—As to growing tobacco in England, there is no doubt that it can be grown with the greatest ease. I never saw such a vigorous grower, unless it was the maize which grew close by. I consider that my crop, none of which was planted before June 17th, and some not till July 14th, and all of which ripened, proves that there is time, and to spare, in any English summer.

The Pennsylvanian was a very vigorous grower, and readily took a bright Manilla colour on curing, without a fire. It was very difficult, however, to get at the suckers, owing to the upright habit of the leaves which clung close to the stem. I fancy, too, that the flavour is not so good as the Virginian.

Flavour.—I am told by American growers that I cannot expect tobacco grown last year to have attained its proper flavour yet. I may, however, say that a leaf of Virginian, cured yellow in the first curing, which I cut up and made into cigarettes, was pronounced by more judges than one to have a really excellent cigarette flavour. The slower-cured tobacco is darker and much ranker, and, as our American friends have warned us it must do till it has gained age, bites the tongue. I gave a bit of a leaf and piece of mid-rib to an inveterate chewer, and received a favourable report on each.

Remarks.—If I grow tobacco again, I shall not spend much on charcoal,

for in my experience the slow curing was much the safer. It is, however, in my opinion, quite necessary to be able to apply sufficient heat, when required, to dry the leaves and make them hard and brittle; for this seems the only way in the damp cold days of November to save the tobacco, even though it has been thoroughly cured and baked, from the attacks of mould.

When I am asked whether tobacco-growing will pay, I say "Yes, if we can grow better quality, or larger quantity, than they can in America." I think it possible that we may do both—and probable that we may win on quantity.

Approximate Cost of Growing.—The following account gives approximately the cost of growing my crop, and carrying it to the oast. I have not continued it further, because my expenses in the curing were, very many of them, unnecessary.

My area was not quite half an acre, as I had not plants enough to fill the measured plot.

I have charged nothing for my own labour in topping, suckering and carrying. It would bring the cost to quite 10*l.*

But experience would no doubt enable me to reduce this total another year. I have charged only 15*s.* for rent, rates, tithes, and taxes—because one half was grown between raspberries, and the other as a second crop, after rye:—

	£	*s.*	*d.*	£	*s.*	*d.*
Seed and cost of raising Plants				0	17	0
Rent, Rates, Tithes and Taxes				0	15	0
Manures				2	2	0
Preparation:—						
Field	1	0	4½			
Plantation	0	12	6			
				1	12	10½
Planting:—						
Field	0	8	10½			
Plantation	0	4	1½			
				0	13	0
Watering				0	4	4¾
Cultivation:—						
Field	0	11	7½			
Plantation	1	2	11½			
				1	14	7
Topping, Suckering, &c.:—						
Field	0	6	0			
Plantation	0	3	4½			
				0	9	4½
Cutting and Carrying				0	15	1
				£9	3	4

I am indebted to Mr. Wingham for the following three communications containing the results of his examination of the tobaccos. The first, dealing with the plants grown by Lord Harris, has already been published in the 'Journal of the Society of Chemical Industry,' February 28th, 1887. The two sections referring to the plants grown by Mr. Wigan and myself are here published for the first time.

Chemical Examination of English-grown Tobaccos.

By Arthur Wingham, F.I.C., F.C.S.

I. Tobacco Grown at Belmont by Lord Harris.

I desire to introduce to the notice of chemists the results of a few analyses and experiments in connection with what may probably become a new industry in this country, viz., tobacco-growing. It is a subject which is being seriously discussed, and in which a great amount of public and scientific interest is being shown. The results obtained and here recorded are purely of a scientific nature and tend to throw considerable light on the subject as far as they go, and have been obtained by experimenting on some samples of English tobacco grown by Lord Harris at Faversham; the work has been carried on in the Chemical Laboratory of the Royal School of Mines and Normal School of Science.

The English samples examined were of four distinct varieties, and were consequently arranged into four lots, which were numbered 1, 2, 3, 4, and examined separately.

The following table shows the average measurements and weights of leaves:—

Average Measurements and Weights of Leaves.

	Length.	Breadth at broadest part.	Weight.
	inches.	inches.	grammes.
No. 1	22	11	12·0
No. 2	16	9	5·4
No. 3	20	7	9·7
No. 4	20	9	8·3

No. 1 was of a uniform moderately deep dull-brown colour, rather thick and tough.

No. 2 was of a light-brown colour, partly green, and thin and somewhat slender.

No. 3 was deeper in colour than No. 1. Thicker also and tougher.

No. 4 was somewhat similar in shape to No. 1, but lighter in colour and thinner, although moderately tough.

All the leaves were damp and unfermented. Before experimenting with them they were dried at 100° C. until no further loss in weight took place.

Percentage of Water.

	Per Cent.
No. 1	21
No. 2	26
No. 3	22
No. 4	20

For the purposes of comparison some samples of foreign tobacco were taken and worked side by side with the English samples, and it would be as well to introduce them here. Unfortunately, these were all fermented leaves, it being impossible to obtain any that had not undergone fermentation. These samples were three in number, and were numbered 5, 6, and 7.

No. 5. American Leaf Strips (Kentucky). Size 24″ by 10.″ This leaf closely resembled No. 1 in appearance and structure, and No. 4 in size. Deeper in colour than any English sample, and reddish-brown. Moderately strong aromatic odour.

No. 6. American Western Strips. Size 18″ by 8″. This leaf was almost exactly the same in appearance and structure as No. 3. Deep in colour, but not reddish-brown. Dark dull-brown, similar to No. 3, but deeper. Slight aromatic odour.

No. 7. *German.* Size 15″ by 6″. Very dark in colour, almost black. Thin leaves, not very strong. Veins tough and stringy, strong odour, but not aromatic.

These samples, Nos. 5, 6, and 7, were selected, Nos. 5 and 6 on account of similarity to English leaves, and No. 7 as being of European growth. They were also dried at 100° C.

The dried leaves of the seven samples were then remeasured, and the weights notified, and from these data a rough idea of the relative weights of the seven samples was obtained by calculating the weight in grammes of one square foot. These results are only approximately accurate, owing to the difficulty of measuring the area of such irregular shapes as those of tobacco-leaves. They are, however, useful and of interest. The following are the results:—

Weight in Grammes of 1 Square Foot of Leaves dried at 100° C.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
13·4	7·5	14·5	8·8	7·5	8·6	8·8

It will be seen that in the English samples, Nos. 1 and 3, the weights per square foot are nearly double those of Nos. 5 and 6, to which respectively they correspond in appearance, &c. During the process of fermentation leaves undoubtedly lose weight, and very considerably so; but whether they would lose so much as the difference above is very doubtful. The samples were then broken up, the mid-ribs removed, and the remainder crushed up into a coarse powder, and thoroughly mixed to obtain a proper homogeneous sample. It was this perfectly dried sample at 100° C. that was taken in all cases for analysis and experiment, and all results expressed in percentages of leaf refer to the leaf as being in this condition, the only one which could be relied upon for constancy.

The amount of ash was first determined with the usual precautions.

Percentage of Ash.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
25·28	22·87	21·19	23·63	16.49	21·41	19·63

In every case the ash was white. In burning the English samples, it was found necessary to continue the heating from the first or they would not burn, and the carbon at a dull red heat burnt off very slowly. In fact, it was with difficulty that the last traces were oxidised. No self-supporting combustion took place at all. On first heating an oil distilled off which burnt with a very luminous flame, especially so in No. 3, which also burnt altogether more readily than the others. The foreign leaves, on the other hand, burnt off very readily, and when once ignited, continued to burn for some time without continuation of the heat. The exact causes of this difference in burning properties will not be discussed here.

From the above results it will be seen that the ash in the English tobacco is very high. This is of importance, as showing that the soil has been highly manured, and that the plant has been probably forced. This is rather

unfavourable, and assuming that the leaves lose weight in fermentation, the percentages of ash in the fermented leaves would be still higher. Taking 20 per cent. as the probable loss in weight during fermentation, the resulting figures would then be, in

	Per Cent.
No. 1	31·6
No. 2	28·6
No. 3	26·5
No. 4	29·5

unusually high results. The highest ash recorded in connection with tobacco-leaves is not over 23 per cent., and the average is very much below this.

A complete analysis of the English samples of ash was then made, with the following results:—

PERCENTAGE COMPOSITION OF ASH.

	No. 1.	No. 2.	No. 3.	No. 4.
Potash (K_2O)	8·02	10·15	7·38	9·09
Soda (Na_2O)	4·42	4·84	4·45	4·64
Lime (CaO)	41·02	38·66	43·16	41·26
Magnesia (MgO)	3·96	3·61	3·92	3·36
Chlorine	28·02	26·95	28·52	27·01
Carbonic acid (CO_2) (by dif.) ..	11·85	12·60	9·69	10·95
Sulphuric acid (SO_3)	4·95	3·72	4·55	3·80
Phosphoric acid (P_2O_5)	2·64	2·78	2·86	3·31
Silica (SiO_2)	1·43	2·76	1·89	2·72
Fe Al	nil.	nil.	nil.	nil.
	106·31	106·07	106·42	106·14
Deduct oxygen equiv. for chlorine	6·31	6·07	6·42	6·14
	100·00	100·00	100·00	100·00

The usual methods of analysis were employed, and therefore need not be detailed.

The ashes of the foreign samples were not analysed. There are many already recorded.

The figures obtained above are very important and useful, and in one or two cases rather remarkable. The most important constituents are the alkalis and the lime. The low percentage of potash and the high percentage of lime speak very badly for the quality of the ash, which should contain a much larger proportion of potassium to lime. The high percentage of chlorine is a most remarkable result, and one also detrimental to good quality. The low percentage of carbonic acid is no doubt due to a certain extent to the excess of lime over potash, a certain amount of caustic lime being produced at the dull red heat required to burn off the carbon. Sulphuric acid is fortunately low, and the phosphoric acid is much below the average. Taken altogether the ashes in the four samples, although varying in percentage on the leaf, seem to be practically the same. Nos. 1 and 3 seem to go side by side in what little difference there is, and the other two are also very close to each other. It will be remembered that 1 and 3, as also 2 and 4, showed a similarity in weight per square foot.

The total nitrogen was then estimated. The method employed was the combustion method, with copper oxide in vacuo. To ensure complete

combustion of the organic matter present, the substance was mixed with an excessive amount of copper oxide in a fine state of powder, and ground down in the mortar with it, then placed in the combustion tube with the copper roll, and burnt in the usual manner. The following are the results:—

PERCENTAGE OF TOTAL NITROGEN.

No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
4·62	4·16	4·67	4·65	4·33	3·52	4·24

The total amount of nitrogen is of no particular assistance in deciding as to the quality of a tobacco, but it is still of interest as showing the amount taken up by the plant from the soil.

What is present in the case of the English samples appears to be all organic nitrogen, as the leaves were tested most carefully for nitrates, and not a trace could be found. This observation applies to the fleshy part of the leaves only, as the veins contained small traces of nitrates and the mid-rib considerable traces. Nitrates were found in the fleshy part of the American samples, however, although in very small quantities.

The condition in which the nitrogen existed was not thoroughly investigated, but sufficient was done to cast very serious doubts on the existing ideas of the changes by fermentation and the causes of the combustibility of tobacco. This subject is being pursued, and I hope at some future date to refer again to it.

The amount of soluble matter in the leaf was next determined. This was done by heating a weighed quantity with distilled water for one hour to a temperature of 80° C. on a steam bath, filtering off the solution, washing the residue, drying it at 100° C. and weighing it. The following figures were obtained:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Soluble extract ..	58·00	58·64	56·55	57·11	45·36	39·70	38·27
Residue	42·00	41·36	43·45	42·89	54·64	60·30	61·73

The results agree very well in the case of the first four samples, but the percentages of soluble extract are very high. It is recorded in connection with foreign tobaccos that the highest extractive obtained in this way was not over 55·0 per cent. and the average is about 10 per cent. lower, so that the extractive in the above four samples is excessive and tends to confirm the previously expressed opinion that the plants have been forced.

The amount of ash contained in the dried leaves after extraction with water was next ascertained, as also the amount of nitrogen, with the following results:—

PERCENTAGE OF ASH AND NITROGEN IN THE RESIDUE FROM AQUEOUS EXTRACT.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Ash..	10·89	11·40	11·71	11·61	13·22	18·78	14·44
Nitrogen..	4·13	3·06	4·25	3·29	3·45	3·21	4·45

It is here worthy of note that the dried residual or washed leaves burnt free from carbon much more readily than the original leaf. The above results were calculated into the percentage on original leaf by allowing for soluble extract, and the amount of ash, as also of nitrogen, extracted by water, was obtained by difference.

PERCENTAGE OF ASH, EXTRACTED BY, AND INSOLUBLE IN WATER.

Ash.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Extracted (by diff.)	20·71	18·16	16·11	18·65	9·27	10·09	10·72
Not extracted ..	4·57	4·71	5·08	4·98	7·22	11·32	8·91
	25·28	22·87	21·19	23·63	16·49	21·41	19·63

These results are very important ones and leave very little doubt as to the artificial nature of the plant. The leaves are immature. The amount of mineral constituents, not extracted by water and which are consequently those forming part of the leaf itself, is exceedingly low in all the English samples, while the amount extracted by water is very high, thus showing the superficial nature of the mineral constituents. The high figures above in the four English samples showing the soluble mineral constituents no doubt account to a large extent for the high percentage of soluble extract of the original leaf.

The amount of soluble and insoluble nitrogen is given in the following table:—

PERCENTAGE OF NITROGEN, EXTRACTED BY, AND INSOLUBLE IN WATER.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Extracted (by diff.)	2·89	2·90	2·82	3·24	2·45	1·59	1·50
Not extracted ..	1·73	1·26	1·85	1·41	1·88	1·93	2·74
	4·62	4·16	4·67	4·65	4·33	3·52	4·24

It will be seen that a similar result in a less marked degree is obtained here as in the case of the mineral constituents:—a higher ratio of soluble nitrogen to insoluble in the case of the English samples than in the case of the foreign. The insoluble nitrogen may be taken to roughly represent the albuminoid nitrogen, as the determination of the albuminoid nitrogen in three of the above samples proved it to be so.

An experiment was next conducted with a view to ascertaining the amount of internal combustion that took place when the leaves were treated without contact with air. Unfortunately these experiments did not prove so simple as was anticipated. Weighed quantities of each sample were placed in small combustion tubes, closed at one end and drawn out at the other, and connected with a Sprengel pump. When a vacuum was obtained, the tubes were heated to very dull redness, about the same temperature being employed in each case. The gases which were produced were collected and measured.

These gases were found to be mixtures of CO, CO_2, N, and hydro-carbons. They were not completely analysed, but the object of the experiment was kept in view, and the oxides of carbon were determined. The CO_2 was absorbed by potash and the CO by cuprous chloride. In this way was obtained the amount of carbon oxidized within the leaf itself. The following are the results:—

CUBIC CENTIMETRES OF GASES COLLECTED FROM 1 GRAMME OF LEAF BURNT IN VACUO.

No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
99·9	94·8	104·7	149·0	137·9	136·1

PERCENTAGE OF CARBON OXIDIZED BY HEATING IN VACUO.

	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Oxidized into CO_2	3·38	3·30	3·63	4·46	4·70	4·33
„ CO	·56	·49	·59	·80	·89	·82
Total	3·94	3·79	4·22	5·26	5·59	5·15

The results of these experiments point in the direction anticipated, viz., that the amount of carbon oxidized in the leaf itself is greater in the foreign and fermented tobacco than in the English and unfermented. A larger quantity of total gases is given off and the amount of both CO_2 and CO is greater. This may be due to the difference of the constitution of the leaves, especially between fermented and unfermented, but it may also arise, and probably does so, from the presence of nitrates to a small extent, and more so to the presence of substances introduced at the time of curing. However, too much importance must not be attached to these figures at present. The experiment requires further investigation and probable modification before results of definite value can be obtained. By some such experiment it might be possible to measure the internal combustibility of tobacco, and this would be an important test. The above experiment tends to show that this can be done, and it is mentioned here as a preliminary experiment of some interest.

Taking the whole of the results into consideration, the opinion may be expressed that they are not, by any means, all unfavourable. It would be out of place at the present time to discuss the probability of tobacco-growing in this country becoming a financial success, and it would be presumptive on the above few results to attempt to prognosticate. The object of these analyses and experiments has been to show the comparative qualities of English and foreign tobaccos. This object has been attained as far as the present samples are concerned, with the result that some of the most serious faults have been laid bare. If the causes of these faults are prevented and guarded against, there is no telling what the result may be. The English leaves are very heavily handicapped on account of not having undergone the process of fermentation and curing, and consequently at present cannot be fairly judged as a tobacco. What the action of fermentation, storing, &c., will be upon them, it is not easy to say. One thing is pretty certain—that the leaves would improve, and they might produce a good tobacco, at any rate better than some of the inferior qualities imported. It must not be forgotten that in the above experiments they have been compared with good foreign samples.

The English leaves are favourable as to size and general appearance, but

they lack body. They fail in being immature, but the reason for this is known, and it might be remedied. As regards burning they will not stand the test applied by manufacturers for cigar-tobacco. The ash also, as shown above, is not of the most desired composition, and this is a matter of very considerable importance.

The one great point, however, is the fermentation. The exact changes which take place during this process are at present little known, and difficult to define. One or two things are evident—that loss in weight takes place due to oxidation of carbon, and probable elimination of nitrogen, and that the mineral constituents not only remain unaltered, but increase in percentage as the fermentation goes on. These facts would produce in the case of the English samples an abnormal quantity of ash, and it is obvious that an organic substance, being to a degree loaded with mineral constituents, which do not lend any aid to the combustion, but on the other hand tend to retard it, will not burn so freely as a similar substance containing less of those constituents. This is evidenced, to a certain extent, in the interesting fact notified above, that the leaves which had been digested with hot water, and from which four-fifths of the mineral constituents had been removed, burnt much more readily than the original leaf.

Comparing these leaves with one another, No. 3, or the long narrow leaf, is decidedly the best, and seems under the circumstances to have thrived better than the others. It is the heaviest in weight and lightest in ash, and moreover burns better than the others. No. 1 is also a heavy leaf, but it is not of such a good quality.

It must not be forgotten that these remarks apply only to the present samples, which were all grown by Lord Harris, and must not be taken as including all English-grown tobacco. I am at present engaged in carrying out similar experiments for Mr. Faunce De Laune on some tobacco grown at Sittingbourne, and I hope to have the pleasure of laying before this Society still more satisfactory results.

II. Tobacco Grown at Sharsted Court by Mr. C. de L. Faunce de Laune.

The leaves consisted of three samples marked as follows:—

No. 1. Not supposed to have been so heavily manured as the other sample.

No. 2. Supposed to have been heavily manured with bats' guano.

No. 3. Nothing special known of this sample, but it has been bulked for several weeks.

					Av. Size. Inches.	Av. Weight. Grams.
No. 1	consisted of	11	leaves	measuring	24 by 10½	7·0
No. 2	,,	5	,,	,,	31 ,, 14	25·4
No. 3*a*	,,	7	,,	,,	24 ,, 12½	18·0
No. 3*b*	,,	2	,,	,,	24 ,, 9	16·0

No. 1 was of a pale yellow colour, similar to Chinese tobacco. Uniform colour and structure, but wanting in body.

No. 2 was of a brown colour, varying in shade. Large leaf with good body. Slightly worm-eaten. Very large mid-ribs and veins.

No. 3 was of a dull brown colour, also varying in shade. Fairly good body in places. Leaves were of different shapes. Some also slightly worm-eaten. This sample contained two leaves quite distinct in appearance and shape from the others. They were excellent leaves as far as could be judged by appearance, in structure, tenacity, and body, with a good and uniform colour.

These two leaves were marked 3*b*, and were weighed and dried separately, but the insufficient quantity prevented them being analysed separately from the others.

The samples were dried at 100° C. and weighed, and the moisture determined with the following results:—

		Per Cent.	
No. 1	contained	20·7	water
No. 2	,,	21·4	,,
No. 3*a*	,,	20·8	,,
No. 3*b*	,,	18·8	,,

3*b* sample was then mixed with the remainder of No. 3*a*. The dried leaves were broken down and the mid-ribs removed. The mid-ribs were very bulky, and were weighed and their percentage calculated.

		Per Cent.		
No. 1	contained	30·4	stalks	in dried leaf
No. 2	,,	26·2	,,	,,
No. 3	,,	21·9	,,	,,

The remainder, consisting of the fleshy part of the leaf, and the smaller veins, constituted, when perfectly dry, the samples that were taken for analysis.

The ash was first determined in the usual manner by heating a weighed quantity to a dull red heat. The following are the results:—

Percentage of Ash.

No. 1.	No. 2.	No. 3.
24·35	17·98	23·23

The samples burnt much more readily than the previous English samples, although there was a slight difficulty in oxidizing the last traces of carbon, especially in No. 1. On first heating, an oil distilled off and burnt with a very luminous flame, No. 2 giving off a very large quantity. Little or no self-supporting combustion was noticed except in No. 3, which continued to burn slightly when once ignited. It will be seen that the quantities of ash in Nos. 1 and 3 are high, No. 2 being fairly low.

Complete analyses of the ash were then made with the following results:—

	No. 1.	No. 2.	No. 3.
Potash	9·52	9·30	10·14
Soda	3·98	2·86	2·40
Lime	37·59	41·44	39·22
Magnesia	3·48	6·32	3·85
Iron Oxide and Alumina	·68	·58	·56
Chlorine	9·15	8·70	8·42
Carbonic Acid (by diff.)	22·68	18·11	18·18
Sulphuric Acid	5·61	5·64	8·58
Phosphoric Acid	3·24	4·14	2·14
Silica..	6·13	4·87	8·41
	102·06	101·96	101·90
Deduct Oxygen equivalent to Chlorine ..	2·06	1·96	1·90
	100·00	100·00	100·00

It will be seen from the foregoing figures that these ashes have the one great fault, which was also so marked in the samples of Lord Harris, viz. the high percentage of lime, and low percentage of potash, and the consequent heavy ratio of the former to the latter. One great advantage, however, which these samples possess over the Faversham samples is the comparatively low percentage of chlorine. This lower quantity of chlorine would act favourably in rendering the burning of the leaf more easy. The higher percentage of silica is also a favourable sign, although, at the same time, there is an undesired increase in the sulphuric acid. Iron is also present in these samples. The manuring in the case of No. 2 seems to have affected the composition of the ash very slightly. Beyond the increase in phosphoric acid and magnesia, there is no particularly marked difference from the others.

The total nitrogen was next estimated with the following results:—

PERCENTAGE—TOTAL NITROGEN.

No. 1.	No. 2.	No. 3.
3·23	5·71	5·29

There is a marked difference in the three samples in these figures. They will be again referred to.

The fleshy part of the leaf in each sample was tested for nitrates. No. 1 contained no nitrates, but Nos. 2 and 3 contained a considerable quantity. This latter result is very unlike what was found in connection with the previous samples examined.

The soluble extractive was then ascertained by heating weighed quantities with water to 80° C. for 1 hour, and weighing the residue. The following figures were obtained:—

	No. 1.	No. 2.	No. 3.
	Per Cent.	Per Cent.	Per Cent.
Soluble	55·95	58·70	52·15
Residue	44·05	41·30	47·85

The soluble matter is high in each case, especially so in No. 2. The average of recorded samples is about 45·0 per cent.

The ash in the residue was then determined and calculated into percentage on the original leaf, when the following figures were obtained, showing the ash or mineral constituents extracted by, and insoluble in water:—

	No. 1.	No. 2.	No. 3.
Ash extracted	17·26	14·29	13·04
" remaining in Residue ..	7·09	3·69	10·19
	24·35	17·98	23·23

The figures speak very favourably for No. 3 sample, and fairly well for No. 1, as regards their maturity, but they condemn No. 2. The superficial nature of its mineral constituents, although the amount is small, is clearly shown by the above result.

The nitrogen in the residue was also estimated with the following results:—

	No. 1.	No. 2.	No. 3.
Nitrogen extracted ..	2·08	3·57	4·22
„ remaining in Residue	1·15	2·14	1·07
	3·23	5·71	5·29

Further experiments are being carried on to ascertain, if possible, the exact forms of combination in which the above nitrogen exists. The nitrogen remaining in the residue may be taken to roughly represent that which exists in the form of albuminoids, as the following determinations of the albuminoid nitrogen prove, except in No. 3:—

Percentage—Albuminoid Nitrogen.

No. 1.	No. 2.	No. 3.
1·28	2·18	1·53

The figures in connection with No. 3 are worthy of careful consideration. They seem to point out the existence of considerable quantity of albuminoids soluble in hot water. It will also be noticed that the quantity of total albuminoid nitrogen is less than in No. 2.

The amount of nitrogen existing as nitrate was determined, but the results obtained require confirmation.

This is as far as the experiments have been carried, so that it would be premature to criticise the leaves too closely at present. The figures are complete, however, as far as the mineral constituents are concerned, and this really forms a very important item as regards the burning qualities of a tobacco, and an opinion may be expressed from them. There is no doubt that such a large proportion of lime to potash in the ash should not exist. The chlorine also should be reduced. Comparing the ashes to those of the Faversham samples, they are certainly an improvement, both in composition, and in the conditions in which they exist in the plant.

Taking the leaves themselves they are larger, stronger, of finer structure, and with more body than the Faversham leaves; but they cannot be said to be good matured leaves. No. 3 probably is the most matured; but No. 2, although very fleshy as far as can be ascertained at present, and also not excessive in ash, is nevertheless very artificial. No. 1 are very good leaves, but they contain very little "substance" in them. There is a very objectionable feature in samples Nos. 2, and 3, viz., the variable shades of colour in the same leaf. Probably the causes of this are known. In sample No. 3, it seemed as though fermentation had taken place in one part of the leaf and not in the other, and in one or two places it appeared as if the fermentation had been abused.

III. Tobacco Grown at East Malling by Mr. W. L. Wigan.

Seven samples were received. Two leaves of each sample were taken and mixed, and produced the sample operated upon. The leaves were treated in

the same way as in the previous samples, and the following are the results :—

	Per Cent.
Original leaves contained	14·0 water
Dried leaves contained	27·0 stalks

The analyses were made upon the remaining 73 per cent. fleshy part of the leaves, after breaking down and thoroughly mixing.

	Per Cent.
Dried sample contained	17·03 ash

having the following percentage composition :—

	Per Cent.
Potash	11·32
Soda	·91
Lime	35·83
Magnesia	3·49
Iron Oxide and Alumina	·70
Chlorine	9·68
Carbonic acid (by diff.)	22·67
Sulphuric acid	5·82
Phosphoric acid	5·25
Silica	6·51
	102·18
Deduct Oxygen equiv. for Chlorine	2·18
	100·00

The amount of soluble extract was then determined.

1 Hour at 80° C. in Water.

	Per Cent.
Soluble extract	49·84
Residue	50·16

The total nitrogen in the dried leaf was found to be 6·54 per cent.

The amounts of ash and nitrogen were determined in the residue from aqueous extract, and the following results were obtained :—

	Ash.	Nitrogen.
	Per Cent.	Per Cent.
Extracted by water	11·42	3·92
Insoluble in water	5·61	2·62
Total	17·03	6·54

The leaves seem to be the most mature that have come under my notice, although I have not had time to fully confirm this opinion. They contain more nitrogen and less ash than the others, and they also contain a fair ratio of ash insoluble in water, to the soluble ash, although even in these samples the ratio is insufficiently high. The leaves have more body than previous samples, better and more uniform colour, and altogether appear to be more natural.

As regards the ash, it will be seen that it has a slightly different composition to the others. The lower percentage of lime, the higher potash, although the total alkaline (potash and soda) are less, the higher phosphoric and carbonic acids are all favourable items in the present sample.

The sample consisted of mixed leaves, some being green and others only

partly fermented, consequently it is not possible to give a fair opinion on the burning properties, as some of the leaves would probably burn better than others. The sample, however, as it was, burnt fairly well, although giving less oil and less luminous flame than the Sharsted Court samples, and more objectionable odours. At the same time the last traces of carbon burnt off very readily.

Judging from the analyses of the three specimens, viz., Faversham, Sittingbourne, and East Malling, which I have examined, my opinion is that they are not at all unfavourable towards the prospect of tobacco-cultivation in England. The analyses lay bare a few faults as regards the constitution of the mineral constituents, and clearly point out one or two of the evils which should be guarded against in the future. The specimens have been examined not so much as to the quality of the tobacco, but more as to the nature of the plant, as the fermentation, &c., would have a great deal to do with the conversion of the leaves into suitable smoking material, consequently the analyses have been confined rather to the inorganic part, with a view of deciding the question of soil and manure. The result of future fermentation experiments will, no doubt, decide the probability of English tobacco-cultivation; but it is, at the same time, necessary that the plant should be grown under circumstances as closely allied to those of its natural requirements as possible, and that a leaf should in the first place be obtained, having a quality of ash more nearly allied to that which is known to exist in the more naturally-grown tobacco than is at present obtained.

Comparing the various samples of the three growths one with the other, it appears that they all suffer very much from one great fault, viz., the high percentage of lime, and a corresponding low percentage of potash. These positions should be reversed, at any rate to some extent. The high percentage of ash also is rather detrimental to the English samples, especially with its present composition. Were means taken to remedy the large quantity of lime, which are at present used in foreign countries when the ash is found to contain too much of that substance, the ash in the English tobacco would be considerably increased; probably an increase of one-third in its quantity.

A great fault also with the Faversham samples, and which does not exist to the same extent in the others, is the amount of chlorine present. This, combining with lime and potash to produce fusible chlorides, had a great effect in retarding the combustion. The chlorides fused and imbedded carbon in their mass, with the result that the last traces were oxidized, at a low temperature, with great difficulty. In the other cases it did not seem to retard the final oxidation very much, although it would tend to have that effect. The 9 per cent. of chlorine should be reduced. The sulphuric acid is low, and should not be allowed to increase, as sulphates also have a very great retarding action on combustion. The remaining mineral constituents have, in my opinion, little or no influence on the burning.

The leaves all seem to be more or less immature, especially the Faversham samples. The large leaves obtained at Sittingbourne, also, are undoubtedly of a forced character, while the smaller and more compact leaves grown near Maidstone seem, although I have not yet examined them thoroughly, to be of a much more natural growth. This seems to suggest that, in forcing the plant and producing large leaves, the organic quality of them would be very materially affected, and if that is so, the advisability of sacrificing quality for quantity is questionable. The organic constituents of these samples have not been studied very deeply, but it is worthy of note that in burning, the Sittingbourne samples, especially the large leaves, gave off very large quantities of an oil burning with a very luminous flame, which was in small quantity in the Faversham samples, while those of East Malling

evolved an oil which did not burn with such a luminous flame, and at the same time produced an excessive quantity of strong-smelling disagreeable odours. Whether the artificial nature of a leaf as regards its organic constituents is a great disadvantage or not, is at present, in my opinion, an open question and remains to be proved.

It must be understood that I do not wish to pretend that the quality of a tobacco can be ascertained from the analysis of its mineral constituents, any more than it can be ascertained from the quantity of nicotine present, but I maintain that the quality of its mineral constituents has a decided influence on the burning, and that a better attention to the supply of the natural requirements of the plant is more likely to produce the other good qualities. A calcareous soil, although it may be rich, is not the best soil on which to cultivate tobacco. A good sandy or alluvial soil, rich in potash felspar, is more of the kind required, and I think that, if this end can in any way be attained, very much better results will be forthcoming. The whole question seems to be one of soil and manure. The long, narrow leaf apparently thrives well in this country, and seems capable of standing the climate, and it is to this variety that attention ought to be paid.

I very much question the propriety of taking the results obtained from the cretaceous* soils of Kent as typical of what can be done in England as regards tobacco-growing.

If, under the existing circumstances, which, as it has been shown, were decidedly not favourable to the natural production of the plant, such good results have been obtained, then under more favourable conditions, if prices will allow, and with better knowledge and experience, I certainly see no reason why tobacco-cultivation should not be carried on in England equally as well as any other agricultural industry.

List of Books.

'Report on the Productions of Agriculture.' Washington, U.S.A. 1883.†

This is perhaps the most useful practical guide for a tobacco-planter.

'Reports on the Cultivation and Preparation of Tobacco in India.' Published at the India Museum Office.‡

(1.) By Dr. Forbes Watson.
(2.) By. J. E. O'Connor.

(1.) A useful book, but not of the same practical use as the former.

(2). This pamphlet contains much scientific information, and is thus valuable to those who wish to make intelligent experiments in tobacco-growing.

'Tobacco, its History and Associations.' By F. W. Fairholt.

A charming book, full of information, and pleasantly and accurately written.

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* This applies to Faversham and Sittingbourne, but not to East Malling.

† *Vide* p. 225 of this article.

‡ *Vide* pp. 222 and 230 of this article.

'English Tobacco Culture.' By E. Beale.*

A manual that will be read with interest by most people. Unfortunately the balance-sheets given are only estimated, and apparently on a maximum and minimum scale. They must be verified before they can be accepted as a practical guide. On page 6, the average American yield is quoted as 1500 lbs. to the acre, whereas Messrs. Carter & Co.'s crop is estimated at 3000 lbs. The engravings in this book are good. I see nothing put down in the cost of the experiment for the shelter which appears in the photograph of Messrs. Carter & Co.'s tobacco-crop.

'Tobacco-growing in Great Britain and Ireland.' By A. A. Erskine.

Useful as entering fully into the arguments on the side of growing tobacco in England, and contains much information that is not to be found elsewhere.

'Tobacco, a Farmer's Crop. By P. Meadows Taylor.

This book deals intelligently with the cultivation of tobacco in France. Ought to be read by any one who wishes to study the subject.

'Tobacco, how to Grow and Cure it.' Richmond, Virginia, 1886.

Although a trade advertisement it contains very useful information for experimenters in tobacco.

VIII.—*Report on the Experiments conducted in* 1886 *by Local Agricultural Societies, in conjunction with the Royal Agricultural Society of England.* By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., F.C.S.

THE desire manifested by several Local Agricultural Societies to carry out in their own districts experiments which might be, it was believed, of practical utility, led the Royal Agricultural Society of England to take into consideration how best they could give their assistance in the matter.

It appeared to be desirable to put to the test of actual farmyard practice, under different conditions of soil and climate, some of the results obtained in the more distinctly scientific experiments that have been for so long carried on by Sir John Lawes and Dr. Gilbert on heavy land at Rothamsted, near St. Albans, and within more recent years by the Royal Agricultural Society at Woburn, Bedfordshire.

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* *Vide* p. 233.

Already the Bath and West of England Society had arranged for the carrying out, by several of their members simultaneously, of an experiment on wheat growing, but it was felt that to the smaller Agricultural Societies scattered over the country assistance, by some plan of co-operation, might possibly be given by the Royal Agricultural Society.

With this view a Special Experiments Committee was appointed, and held their first meeting at Hanover Square on July 1st, 1885, Mr. William Wells being elected Chairman. Mr. Wells submitted the draft of a scheme of procedure respecting agricultural experiments to be carried on in conjunction with any Local Agricultural Society; and, on the motion of Earl Cathcart, it was resolved that, "in regard to agricultural experiments, the Committee is inclined to recommend co-operation with Local Societies or individuals on the principle of free association." A further meeting was held on July 15th, several members of the Committe having in the meantime sent in suggestions as to the carrying out of the scheme. It was then decided to issue an invitation to the Councils of County Agricultural Societies for a conference of representatives of such societies to be held during the Smithfield week, "for the purpose of considering how far it is possible to establish a system of co-operation in carrying out investigations on subjects of practical utility to agriculture."

The conference was accordingly held, the following Societies being represented:—Bath and West of England, Derbyshire, Durham, Essex, Lincolnshire, Norfolk, Northumberland, Oxfordshire, Peterborough, Royal Manchester and Liverpool, Warwickshire, Wiltshire, and Yorkshire.

The Committee finally, on March 3rd, 1886, submitted to the Council the following proposals for assisting the Local Agricultural Societies:—

That the Royal Agricultural Society should, on application from a Local Society, either suggest one or more experiments themselves, or endorse, after examination and approval, any experiment proposed by the Local Society, and should give assistance in the following manner:—

1. By analysing, at the cost of the Royal Agricultural Society, the soil, manures, and feeding stuffs.
2. By the advice generally of the Chemist of the Royal Agricultural Society, in conjunction with Sir J. B. Lawes and Dr. Gilbert.
3. By an occasional inspection from time to time.
4. By furnishing a report on the experiments, to be inserted, if thought well, in the 'Journal.'
5. By having at Woburn, if thought advantageous to do so, similar experiments for comparison.
6. By the distribution among the Local Society of schemes of the proposed experiments, and the results obtained.

The Local Society to satisfy the Council of the Royal Agricultural Society of the efficiency of the Local Superintendence.

This report was adopted, and circulated among the different Local Societies.

Some of the societies wished to submit schemes of their own for adoption, and others said they would like the Royal Agricultural Society to suggest a scheme.

The season having already considerably advanced, experiments on root crops were selected, and a scheme for these was drawn up by Sir John Lawes, Dr. Gilbert, and Dr. Voelcker.

At the next meeting of the Special Committee, held on April 6th, communications were received from the societies desirous of co-operation, and some of these were represented personally.

The Norfolk Chamber of Agriculture—which had been the first to move in the matter—submitted for adoption experiments on barley, which had been already commenced by them, and they also wished to carry out the proposed experiments on roots. The requirements as to local superintendence being met in this case, the schedule of experiments was adopted. Similarly, the scheme of the Essex Society for experiments on mangolds and that of the Royal Manchester, Liverpool, and North Lancashire Society for experiments on pasture and grasses were adopted. Shortly after this, the Yorkshire Agricultural Society undertook to carry out the scheme suggested by the Royal Agricultural Society, so far as it applied to the swede crop. These were, accordingly, the four societies which worked in co-operation with the Royal Agricultural Society in 1886. The Consulting Chemists of the different societies were :—

Norfolk	Mr. F. Sutton, F.C.S., F.I.C.
Essex	Mr. Bernard Dyer, B.Sc., F.I.C.
Royal Manchester..	Mr. Alfred Smetham, F.I.C., F.C.S.
Yorkshire	Mr. T. Fairley, F.R.S.E.

Assistance was, where desired, given by the Royal Agricultural Society in analysing manures, &c., free of cost to the Local Societies; visits of inspection also were made, and in one instance (Norfolk Chamber of Agriculture) assistance was given in weighing and recording results.

Each Local Society drew up its own report to its members, and these were duly presented to the Special Experiments Committee, when they were adopted, and an abstract of them was recommended for insertion in the 'Journal.'

1. Norfolk Chamber of Agriculture.

Under the direction of Mr. F. J. Cooke, of Flitcham Abbey, King's Lynn, Mr. Garrett Taylor, of Trowse, Norwich, and Mr. B. B. Sapwell, of Sankence, Aylsham, the different sets of experiments undertaken by the Chamber have been very thoroughly carried out.

A. Experiments on Barley after Swedes drawn off the Land. (Whitlingham.)

The land selected was a very level field on Mr. Garrett Taylor's farm at Whitlingham, near Norwich. The soil was a light grittish, sandy loam, about 2 feet deep, with a subsoil of sand. A chemical analysis of it gave its composition as represented in column A :—

(Soils dried at 212° F.)

	A.	B.
*Organic matter and loss on heating	1·65	1.94
Oxide of iron	2·18	1·65
Alumina	·61	2·16
Carbonate of lime	·13	·86
Sulphate of lime	·45	trace
Magnesia	·46	·53
Potash	·14	·30
Soda	·02	·11
Phosphoric acid	·09	·19
Insoluble silicates and sand	94·27	92·26
	100·00	100·00
* Containing nitrogen	·11	·13
Equal to ammonia	·13	·16

A consideration of the figures would lead to the conclusion that the soil A was in poor condition, that it was deficient especially in phosphoric acid and potash, while the quantity of lime was also small. The previous crop on the land was swedes, grown with 5 cwt. per acre of dissolved bones, and the whole were carted off the land. The plan of manuring and results are given in Table I. (p. 256). The plots were half-acre ones. The part of the field not occupied by the experimental plots had been folded with sheep consuming the swedes on the land. Barley was also grown here, and a plot equal in size to the others was cut out and weighed.

TABLE I.—BARLEY AFTER SWEDES DRAWN OFF (WHITLINGHAM).

Plot	Manures per Acre.	Corn per Acre. Weight.	Bushels.	Weight per Bushel.	Straw.
		lbs.		lbs.	cwt. qrs. lbs.
1	1 cwt. nitrate soda, 2 cwt. muriate potash	2366	43·4	54·5	23 1 20
2	1 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash, 10 cwt. gypsum	2707	50·4	53·7	27 0 26
3	1 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash	2732	52·33	52·2	29 1 14
4	¾ cwt. sulphate ammonia, 4 cwt. superphosphate, 2 cwt. muriate potash ..	2728	50·5	54·0	28 1 6
5	4 cwt. superphosphate, 2 cwt. muriate potash	2464	44·5	54·0	25 1 26
6	¾ cwt. sulphate ammonia, 2 cwt. superphosphate, ¾ cwt. muriate potash ..	2722	51·1	53·25	25 0 4
7	1½ cwt. sulphate ammonia, 4 cwt. superphosphate, 2 cwt. muriate potash ..	2722	53·74	50·65	25 2 24
8	2 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash	3276	63·4	51·65	33 1 13
9	*Nothing*	2060	38·7	53·25	18 3 4
10	1 cwt. nitrate soda, 4 cwt. superphosphate	2290	43·2	53·0	23 1 4
11	*Nothing*	..	..	..	..
12	*Nothing*	2028	38·63	52·5	21 0 0
13	*Nothing*	2136	41·5	51·5	19 1 24
14	1 cwt. nitrate soda, 2 cwt. superphosphate, ¾ cwt. muriate potash	2746	52·55	52·25	27 1 18
	Roots folded with sheep	3240	60·3	53·75	32 1 26
	" " " duplicate	3294	61·3	53·75	31 0 2

B. EXPERIMENTS ON BARLEY AFTER WHEAT. (WHITLINGHAM.)

The selected field was near field A, but the soil was stiffer and apparently better. Its chemical composition is given in the column marked B, page 255.

It is considerably richer in phosphoric acid and in potash than A, and has more lime.

The previous wheat crop had been manured with 15 loads of dung per acre.

The plan of manuring and results are given in Table II. The plots were ½-acre ones, and over the rest of the field barley was grown (without manure).

It is impossible to attempt more than a very brief summary of the principal features brought out in the experiments. They are mentioned more in detail in the report presented by the Sub-Committee to the Norfolk Chamber of Agriculture, to which reference should be made.

TABLE II.—BARLEY AFTER WHEAT (WHITLINGHAM).

Plot	Manures per Acre.	Corn per Acre.			Straw.
		Weight.	Bushels.	Weight per Bushel.	
		lbs.		lbs.	cwt. qrs. lbs.
1	1 cwt. nitrate soda, 2 cwt. muriate potash	1966	36·1	54·44	21 3 26
2	1 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash, 10 cwt. gypsum	2291	41·65	55·0	25 2 7
3	1 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash	2028	36·9	55·0	25 0 16
4	*Nothing*	1642	30·0	54·75	16 2 6
5	4 cwt. superphosphate, 2 cwt. muriate potash	1906	34·8	54·75	18 1 17
6	¾ cwt. sulphate ammonia, 4 cwt. superphosphate, 2 cwt. muriate potash ..	1913	34·94	54·75	20 0 11
7	1½ cwt. sulphate ammonia, 4 cwt. superphosphate, 2 cwt. muriate potash ..	2121	38·74	54·75	24 0 22
8	2 cwt. nitrate soda, 4 cwt. superphosphate, 2 cwt. muriate potash	2331	42·0	55·5	23 3 21
9	*Nothing*	1751	31·7	55·25	18 3 1
10	1 cwt. nitrate soda, 4 cwt. superphosphate	1832	33·6	54·5	23 0 23
11	1 cwt. nitrate soda, 2 cwt. superphosphate, ¾ cwt. muriate potash	2288	40·5	56·5	23 1 23
12	¾ cwt. sulphate ammonia, 2 cwt. superphosphate, ¾ cwt. muriate potash ..	2156	38·5	56·0	19 2 2

A most striking feature is the fact that a considerably higher produce was obtained on field A, from which the swedes had been entirely removed, and which one would have thought had become impoverished thereby, than on field B where wheat (dunged) had been grown, especially as the latter is the richer

soil. The difference, it is believed, lies in the drilling, A having been drilled under perfect conditions and B in wet weather. B is also more exposed, and the land is colder. The unmanured plots in either field have given results agreeing well and speaking as to the uniformity of the soil. Lime applied as gypsum was of no use in A, but was so in B. It would be safer not to draw any conclusion in the absence of duplicate plots and the difference shown in the two fields. Judging from the analysis, it is most likely that a dressing of lime would be beneficial in both cases, but gypsum was probably not applied early enough to tell this season.

Great interest centered in the question as to how far potash would be either required or beneficially applied, experiments conducted by Mr. Cooke at Flitcham on this subject having produced very remarkable results.

One plot, No. 1 of field A, was injured by hares to so great an extent that it could not be fairly reckoned in. This is very unfortunate, as it prevents several important comparisons being made. There is, however, clear evidence to show that the produce of A was increased very decidedly by the application of potash (compare plots 10, 2, 3, 4); that nitrogenous manures were required (compare 5, 3, 4, 7), and that nitrate of soda gave better results than sulphate of ammonia. Plot 14, manured with 1 cwt. nitrate of soda, 2 cwt. superphosphate, and $\frac{3}{4}$ cwt. muriate of potash per acre, proved, on the whole, the most economical manuring. The heavier produce of plot 8 was not deemed a safe crop for standing in case of bad weather. The plots folded with sheep were very heavily treated, considerably more richly indeed than would ordinarily occur.

In field B, the most economical manuring proved, as in the case of A, to be 1 cwt. nitrate of soda, 2 cwt. superphosphate, and $\frac{3}{4}$ cwt. muriate of potash per acre, and again nitrate of soda was better than sulphate of ammonia.

Putting together the results, they would indicate that in both fields there was benefit to be derived from the use of potash, but that a small quantity ($\frac{3}{4}$ cwt. muriate of potash per acre) was sufficient, while nitrate of soda, to the extent of 1 cwt. per acre, was sufficient and best to use, and that the addition of 2 cwt. of superphosphate per acre was also advisable. In other words, that the combination of mineral (including some potash) manures with nitrate of soda was the best for such land. The question of liming cannot be regarded as decided.

C. Experiments on Barley after Green Turnips drawn off (Flitcham).

Table III.—Barley (Massingham Break).

Plot.	Manures per Acre.	Corn per Acre.			Weight. Straw, Chaff, &c.
			Bushels.	Weight per Bushel.	
				lbs.	tons cwt. qrs. lbs.
1	3 cwt. nitrate soda, 3 cwt. superphosphate, 2 cwt. muriate potash	Best Dross	54·2 3·0	54·7 0	1 8 0 24
2	3 cwt. nitrate soda, 3 cwt. superphosphate	Best Dross	9·2 11·5	52·2 0	0 13 3 10

The soil at Flitcham is a very different one to that at Whitlingham, being a very thin loam, not above 5 or 6 inches deep, interspersed with chalk and flints, and resting on chalk. An analysis of the soil from one of the fields gave:—

Soil dried at 212° F.

*Organic matter and loss on heating ..	4·65
Oxide of iron and alumina	3·11
Carbonate of lime	19·76
Magnesia	·26
Potash	·10
Soda	·27
Phosphoric acid	·15
Insoluble silicates and sand	71·70
	100·00

* Containing nitrogen	·13
Equal to ammonia	·15

The soil, it will be noted, is very deficient in potash, but at the same time the difference between it and the Whitlingham soil in respect of potash is not so great as in itself to account for the astonishing results recorded from the direct application or omission of potash. Had the experiments not been in this and also in previous years visited by many interested in them, the results must certainly have been received incredulously. The application or omission of 2 cwt. muriate of potash per acre has made a difference of no less than 45 bushels of corn per acre! In short, on this land, without potash the barley crop is an almost entire failure. Mr. Cooke remarks that though 2 cwt. per acre of muriate of potash were used, probably 1 cwt. would be sufficient. These experiments on chalky soil, and the

influence of potash on such soils, open up a new and most interesting and valuable field of enquiry.

D. Experiments on Barley after Barley (Flitcham).

Table IV.—Barley (Long Break).

Plot.	Manures per Acre.	Corn per Acre.			Weight. Straw, Chaff, &c.
			Bushels.	Weight per Bushel.	
				lbs.	tons cwt. qrs. lb.
3	1¾ cwt. sulphate of ammonia, 3 cwt. superphosphate, 2 cwt. muriate potash	Best Dross	31·6 0·5	54·7 0	0 16 0 16
4	2½ cwt. nitrate soda, 3 cwt. superphosphate, 2 cwt. muriate potash	Best Dross	41·5 1·1	54·2 0	1 2 0 22

In this experiment it was sought to test whether sulphate of ammonia, or the equivalent of nitrogen as nitrate of soda, would give the better result. The theory that sulphate of ammonia loses ammonia by its application to chalky soils gains strength from the results, which are much in favour of the nitrate. Still the result cannot be regarded as conclusive, as a somewhat similar result was this year obtained on the non-chalky soil at Whitlingham.

These experiments on chalk land show most forcibly the desirability of instituting experiments on all varieties of soil.

E. Experiments on Swedes.

This was the scheme drawn up by the Royal Agricultural Society, and it was carried out by the following gentlemen.

(1.) Mr. Garrett Taylor, at Whitlingham.
(2.) Mr. Cooke, at Flitcham.
(3.) Mr. Sapwell, at Aylsham.

The plan of manuring and results are given in Table V. The plots 1–12 are those in the original scheme. The others, 13–18, are supplementary ones added by the Norfolk Chamber of Agriculture.

The swede field at Whitlingham is a light loam with a sandy subsoil.

At Flitcham a thin surface of lightish mixed soil on chalk; and at Aylsham a light mixed surface soil of about 12 inches over 10 feet of bright clean building sand.

(1) At Whitlingham 15 tons of swedes were grown without

Table V.—Swedes.

Plot.	Manures per Acre.	Place of Experiment.	Roots per Acre. tons.	cwt.	qrs.	lbs.	Tops per Acre. tons.	cwt.	qrs.	lbs.
1	12 loads dung	Whitlingham	15	2	0	0	2	9	0	0
		Flitcham ..	17	13	0	21	4	1	1	0
		Aylsham ..	15	16	0	0	1	14	0	0
2	6 loads dung, 4 cwt. superphosphate	Whitlingham	18	14	2	0	2	1	1	20
		Flitcham ..	17	13	1	14	4	0	2	9
		Aylsham ..	17	6	0	0	1	13	0	0
3	4 cwt. superphosphate, 1½ cwt. nitrate of soda	Whitlingham	20	10	0	0	2	3	2	0
		Flitcham ..	14	8	0	0	5	0	3	0
		Aylsham ..	15	6	0	0	2	1	2	0
4	4 cwt. superphosphate, 1½ cwt. nitrate of soda, 2 cwt. sulphate potash	Whitlingham	18	8	0	0	2	8	2	0
		Flitcham ..	19	5	1	4	5	0	1	21
		Aylsham ..	17	12	0	0	2	0	0	0
5	*Nothing*	Whitlingham	15	4	0	0	2	3	0	0
		Flitcham ..	12	17	1	21	4	0	1	19
		Aylsham ..	10	13	0	0	1	13	0	0
6	4 cwt. ground coprolite ..	Whitlingham	14	5	0	0	2	2	0	0
		Flitcham ..	12	1	3	17	4	0	2	7
		Aylsham ..	12	8	0	0	1	14	0	0
7	*Nothing*	Whitlingham	15	10	0	16	2	4	1	4
		Flitcham ..	16	0	0	14	4	0	3	21
		Aylsham ..	11	2	0	0	1	13	0	0
8	4 cwt. superphosphate	Whitlingham	13	9	0	0	2	9	0	0
		Flitcham ..	14	9	2	11	5	0	0	0
		Aylsham ..	14	10	0	0	1	14	2	24
9	4 cwt. superphosphate, 1¼ cwt. sulphate ammonia	Whitlingham	20	9	1	20	2	16	0	0
		Flitcham ..	16	1	0	9	5	0	2	21
		Aylsham ..	15	6	0	0	1	8	0	0
10	4 cwt. superphosphate, 1¼ cwt. sulphate ammonia, 2 cwt. sulphate potash	Whitlingham	19	13	0	8	2	14	0	0
		Flitcham ..	20	1	1	22	5	0	0	21
		Aylsham ..	16	8	0	0	1	15	2	14
11	4 cwt. superphosphate, 2 cwt. sulphate potash	Whitlingham	11	8	2	24	2	1	1	20
		Flitcham ..	17	12	0	14	4	0	1	23
		Aylsham ..	16	12	0	0	1	15	1	20
12	6 loads dung, 4 cwt. superphosphate, 1½ cwt. nitrate soda	Whitlingham	18	0	1	20	2	10	2	0
		Flitcham ..	20	1	1	18	5	0	2	14
		Aylsham ..	17	8	0	0	2	7	0	0
13	4 cwt. superphosphate, mixed with ½ cwt. bone flour ..	Whitlingham	20	1	1	20	2	19	0	0
		Aylsham ..	16	3	0	0	no account			
13	6 cwt. dissolved bones, 1 cwt. muriate potash	Flitcham only	20	17	2	10	6	0	1	21
14	6 cwt. superphosphate, 1½ cwt. nitrate soda, 1 cwt. muriate potash	Whitlingham	18	16	0	0	3	2	0	0
		Flitcham ..	19	4	1	12	6	0	2	0
		Aylsham ..	18	16	0	0	no account			
15	4 cwt. dissolved bones, 1 cwt. nitrate soda	Whitlingham	19	16	0	0	2	16	0	0
		Flitcham ..	16	16	2	16	5	0	1	21
		Aylsham ..	16	2	0	0	2	4	0	0
16	3 cwt. superphosphate, 1 cwt. muriate potash, 3 cwt. fish-guano, at Whitlingham. (3 cwt. bat-guano used instead of fish-guano at other places)	Whitlingham	20	13	0	0	2	8	0	0
		Flitcham ..	20	1	2	0	5	0	3	21
		Aylsham ..	16	11	0	0	1	13	1	4
17	3 cwt. superphosphate, 1 cwt. muriate potash, 1 cwt. nitrate soda, top-dressing, 3 cwt. fish-guano, at Whitlingham. (3 cwt. bat-guano instead, other places) ..	Whitlingham	20	12	2	0	2	6	1	4
		Flitcham ..	20	17	1	2	6	0	3	25
		Aylsham ..	18	0	0	0	2	3	2	0
18	4 cwt. superphosphate, 1 cwt. muriate potash, 1 cwt. nitrate soda (top-dressing) ..	Whitlingham	14	16	0	0	1	18	2	0
		Flitcham ..	20	1	2	0	6	0	3	10
		Aylsham ..	16	5	0	0	2	0	0	0

manure, the duplicate plots agreeing well with one another. The principal features shown at Whitlingham were, that dung alone gave no increase over the unmanured plots, but that dung and superphosphate mixed did so, viz. 3 tons per acre. With superphosphate alone a reduced yield was obtained, though when mixed with ½ cwt. per acre of bone-flour, an increase of 5 tons per acre was got. This raises the question whether the superphosphate, by reason of its acidity, proved injurious to the land, which was poor in lime, and whether the neutralisation of the free acid by the bone-flour prevented this injury. The report of the Norfolk Chamber inclines to this opinion, but as against it plot 3 must be mentioned, in which superphosphate mixed with 1½ cwt. nitrate of soda produced a yet higher result, as also plot 9 (superphosphate with sulphate of ammonia). In these no harm was done by the superphosphate. It may be the case that superphosphate should be neutralised before being used on such a soil, but the evidence is by no means clear, and only appears when superphosphate is used alone. Ground coprolites did no good at all; and as for potash—found so useful in the barley experiments—there was not only no increase, but its use was seemingly attended with loss. Between sulphate of ammonia and nitrate of soda there was little to choose. On the whole, these two last named, in conjunction with superphosphate, proved about the best manures for swedes.

(2) At Flitcham there was considerable difference between the duplicate unmanured plots. Superphosphate was used here unmixed with bone-flour, the land being so chalky, and it gave a certain, but not large increase. Nitrogen added to it increased the yield, and, contrary to the results at Whitlingham, potash (as sulphate) applied in addition gave a yet further increase. Plot 18 would indicate that a lesser amount than 2 cwt. of sulphate of potash per acre would suffice, though plot 14 is not quite in harmony with this. Ground coprolites here, too, have done no good.

(3) At Aylsham the duplicate unmanured plots agree well, and while there is a small gain with ground coprolites, that with superphosphate used alone amounts to 3½ tons per acre, and when bone-flour is mixed with the latter, to still more. Nitrogenous manures added to superphosphate gave a less increase than in the case of Whitlingham and Flitcham, and to the addition of potash a small benefit only accrued.

F. Experiments on Mangolds (Whitlingham).

This scheme was also the one issued by the Royal Agricultural Society, so far as plots 1–5 and 7–11 were concerned, the other plots being added by the Norfolk Chamber of Agriculture.

The plan of manuring and results obtained are given in Table VI.

TABLE VI.—MANGOLDS (WHITLINGHAM).

Plot.	Manures per Acre.	Roots: tons	cwt.	qrs.	lbs.	Leaves: tons	cwt.	qrs.	lbs.
1	20 loads dung	23	4	0	0	3	19	0	0
2	10 loads dung, 2 cwt. nitrate soda	27	0	0	0	4	3	0	16
3	4 cwt. superphosphate, 2 cwt. nitrate soda	20	11	2	0	4	0	0	0
4	*Nothing*	14	5	2	0	3	4	0	0
5	4 cwt. superphosphate, 2 cwt. sulphate potash	17	5	3	20	3	4	0	0
6	4 cwt. superphosphate, 1 cwt. nitrate soda, 3 cwt. common salt, 1 cwt. nitrate soda top-dressing after singling	25	13	0	12	4	0	1	24
7	4 cwt. superphosphate	12	11	1	20	2	6	2	0
8	4 cwt. superphosphate, 1½ cwt. sulphate ammonia	15	4	2	16	2	14	3	16
9	4 cwt. superphosphate, 1½ cwt. sulphate ammonia, 2 cwt. sulphate potash	20	2	0	12	3	11	3	18
10	4 cwt. superphosphate, 2 cwt. nitrate soda, 2 cwt. sulphate potash	23	2	1	6	3	17	0	14
11	*Nothing*	14	7	0	12	2	14	3	26
12	4 cwt. dissolved bones, 1 cwt. sulphate ammonia, 1 cwt. muriate potash	20	8	0	0	4	2	2	0
13	3 cwt. superphosphate, 4 cwt. fish-guano, 1 cwt. muriate potash	20	8	0	0	4	7	0	0
14	3 cwt. superphosphate, 4 cwt. fish-guano, 1 cwt. muriate potash, 1 cwt. nitrate soda top dressing after singling	19	18	2	0	3	17	1	20
15	4 cwt. superphosphate, 1¼ cwt. sulphate ammonia, 1 cwt. muriate potash, 1 cwt. nitrate soda top dressing after singling ..	21	9	0	0	4	0	2	0

The soil of this field is a light loam, about 2 feet deep, with a sandy subsoil.

The duplicate unmanured plots are again very even. Dung, at the rate of 20 loads per acre, gave a capital increase, and a still larger one resulted from the use of half the quantity of dung with 2 cwt. nitrate of soda per acre. Superphosphate used alone gave a result below the unmanured, though with nitrate of soda added 20 tons of roots were grown to the acre. Sulphate of potash added to this last mixture yielded 3 tons more per acre, and its addition to superphosphate and sulphate of ammonia was also beneficial. Nitrate of soda gave better results than sulphate of ammonia. In one experiment suggested by the Norfolk

Chamber (plot 6) salt was used, and on this plot the highest produce of all was obtained, the 3 cwt. salt per acre being used in conjunction with 4 cwt. superphosphate and 2 cwt. nitrate of soda (1 cwt. with the seed, and 1 cwt. as a top-dressing). It would have been of interest to know whether potash in some form added to the common salt, would have still further increased the yield.

From a perusal of these experiments on barley and on root-crops, it is evident that much information on several points of manuring, and notably with reference to the use of potash-salts, has been elicited, and that a continuation of these experiments is most desirable.

2. Essex Agricultural Society.

Experiments on Mangolds.

[*Abstract of Report of* Mr. Bernard Dyer, B.Sc., F.C.S., &c. Consulting Chemist to the Society.]

The Experiments Committee appointed by the General Committee of the Society decided to experiment on the mangold crop, and were fortunate in securing the co-operation of Mr. Edward Rosling, of Melbourne, Chelmsford, who placed a portion of a field at their disposal, and undertook the carrying out of the scheme drafted by the Committee. The object of the experiments was to ascertain whether sulphate of ammonia or nitrate of soda furnished the more desirable form of artificial nitrogenous manure for mangolds, and whether in each case it was desirable to apply the manure at the time of sowing, or later on as top-dressing. The field selected consisted of a loam of decidedly stiff and clayey appearance, resting on a gravel subsoil. Wheat after clover was the crop grown in 1885.

Chemical Analysis of Fine Soil, dried at 212° *Fahr.*

Silica and silicates insoluble in hydrochloric acid	85·166
Oxide of iron	3·860
Alumina	4·670
Lime	·821
Magnesia	·300
Potash	·347
Soda	·106
Phosphoric acid	·141
Sulphuric acid	·048
Nitric acid	·001
Chlorine	·002
Carbonic acid (combined)	·180
*Organic matter, water of combination, &c.	4·358
	100·000

* Containing nitrogen .. .. .. ·189

The experimental field was dunged throughout, with the exception of one quarter-acre plot, the object of the experiments being to ascertain the most economical mode of supplementing dung, not of replacing it. The land having been ploughed into ridges or baulks, the dung—20 small loads, or about 12 tons per acre—was spread in the furrows, and the artificial manures—except, of course, those to be used afterwards as top-dressing—were also spread in the furrows, on the top of the dung. The intervening ridges, 2 ft. 6 in. from crown to crown, were then split by the plough, forming new furrows alternating with the old ones, each of which became, of course, replaced by a new compound ridge or "baulk" enclosing the manure. The seed, Yellow Globe Mangold, was drilled on the top of these ridges.

The seed was sown on April 27th. The young plant was singled out in June, and the top-dressings—where used—were applied on July 7th.

The crop was taken up during the third week in November, and the trimmed roots were carefully weighed on a weigh-bridge, as they were carted from the field.

The weights of the trimmed roots calculated per acre, are given below, side by side, with the manures used:—

Plot.	Manure per Acre.	Mangolds per Acre.			
		tons	cwt.	qrs.	lbs.
N	No dung, no artificial manures	14	12	2	20
J	12 tons dung, no artificial manures	22	12	1	8
C	12 tons dung, 3 cwt. superphosphate	22	10	0	16
A	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate of soda applied at seed time	23	4	2	4
H	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate of soda top-dressed in July	24	10	2	0
I	12 tons dung, 3 cwt. superphosphate, ¾ cwt. sulphate of ammonia applied at seed time	24	13	1	4
B	12 tons dung, 3 cwt. superphosphate, ¾ cwt. sulphate of ammonia top-dressed in July, ...	22	14	3	12
D	12 tons dung, 3 cwt. superphosphate, 2 cwt. nitrate of soda applied at seed time	26	0	1	20
K	12 tons dung, 3 cwt. superphosphate, 2 cwt. nitrate of soda top-dressed in July	25	16	2	0
L	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of ammonia applied at seed time	25	0	3	0
E	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of ammonia top-dressed in July	24	7	1	4
M	12 tons dung, 3 cwt. superphosphate, 1 cwt. nitrate soda mixed with 1 cwt. salt top-dressed in July	24	1	0	4
F	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of potash, top-dressed in July with 1 cwt. nitrate of soda	23	3	0	4
G	12 tons dung, 3 cwt. superphosphate, 1½ cwt. sulphate of potash, ¾ cwt. sulphate of ammonia applied at seed time	18	13	2	16

The monetary value of the results is expressed in the following Table:—

Plots.	Artificials per Acre.	Cost per Acre.			Increase in Crop per Acre as compared with Dung alone.				Cost per ton of increased yield of Mangolds.		
		£	s.	d.	tons	cwt.	qrs.	lbs.	£	s.	d.
C	Superphosphate	0	10	6	no increase					..	
A	Superphosphate, 1 cwt. nitrate sown early	1	2	6	0	12	0	24	1	17	0
H	Superphosphate, 1 cwt. nitrate top-dressed in July	1	2	6	1	18	0	12	0	11	9
I	Superphosphate, ¾ cwt. sulphate of ammonia sown early	1	0	6	2	0	3	24	0	10	0
B	Superphosphate, ¾ cwt. sulphate of ammonia top-dressed in July	1	0	6	0	2	2	4	8	1	8
D	Superphosphate, 2 cwt. nitrate sown early	1	14	6	3	8	0	12	0	10	1
K	Superphosphate, 2 cwt. nitrate top-dressed in July	1	14	6	3	4	0	20	0	10	9
L	Superphosphate, 1½ cwt. sulphate of ammonia sown early	1	10	4	2	8	1	20	0	12	6
E	Superphosphate, 1½ cwt. sulphate of ammonia top-dressed in July	1	10	4	1	14	3	24	0	17	4
M	Superphosphate, 1 cwt. nitrate, 1 cwt. salt	1	6	6	1	8	2	24	0	18	5
F	Superphosphate, 1½ cwt. sulphate of potash, 1 cwt. nitrate top-dressed in July	1	18	7	0	10	2	24	3	12	0
G	Superphosphate, 1½ cwt. sulphate of potash, ¾ cwt. sulphate of ammonia	1	16	7	decrease of 3	18	2	20		..	

The first point to be noticed is that the superphosphate alone, in conjunction with 12 tons of dung, did no good. In fact, the yield was a trifle under that of dung alone. Whether the superphosphate helped the nitrogenous artificial manures, or whether on this particular soil it was useless in presence of a fair dressing of good dung, cannot be decided from the experiments. The largest increase was given by the use of 2 cwt. per acre of nitrate of soda, which produced over 3 tons—in one case nearly 3½ tons—extra roots, at a cost only fractionally above 10*s.* per ton. It would not seem in this case (see plots D and K) to have greatly mattered whether the nitrate was sown with the seed, or top-dressed later on, but that it is in accordance with sound principle to apply the nitrate as a top-dressing and not to sow it at seed time seems to be clearly demonstrated by the results of plots A and H, where 1 cwt. of nitrate only was used. The top-dressed nitrate gave close upon 2 tons of extra roots, at a cost of 11*s.* 9*d.* per ton; while a like quantity sown with the seed, gave but 12 cwt. extra roots, at the prohibitive cost of 1*l.* 17*s.* per ton. With sulphate of ammonia the case is reversed. 1½ cwt. sulphate of ammonia, top-dressed, gave about 1¾ tons

increase in crop, but at a cost of over 17*s.* per ton (plot E); but a like quantity sown early gave 2 tons 8 cwt., at a cost of 12*s.* 6*d.* only per ton (plot L). Half the quantity ($\frac{3}{4}$ cwt.) sulphate of ammonia top-dressed, gave but a nominal increase of 2 cwt. per acre (plot B) at the fabulous cost of 8*l.* per ton—in other words, the manure was simply wasted; but a like quantity sown with the seed (plot I), gave 2 tons of roots increase at 10*s.* per ton. Potash was of no use. In fact it decreased the yield in plot F, as compared with that of plot H. In the case of plot G, the decrease is very great as compared with dung alone. In this case the $1\frac{1}{2}$ cwt. sulphate of potash per acre was associated with $\frac{3}{4}$ cwt. sulphate of ammonia. The season was very dry, and it is possible that the saline matters being but slowly diffused in the soil were too strong for the young plant. It must also be noticed, however, that in this plot the condition of tilth was perhaps hardly as good as on the rest of the field, and being close to a gate the ground was probably more consolidated, owing to its having during previous years been more trampled during dung carting, &c., than other parts of the field. Salt with nitrate (plot M) gave a less yield than nitrate without salt.

To summarise, the experiments show:—

1. That on this particular soil the supplementary use of superphosphate only, about 12 tons of dung per acre being used, gave no increase in the mangold crop.

2. That soluble nitrogenous manures in conjunction with superphosphate largely increased the yield.

3. That nitrogen in the form of nitrate of soda was more efficacious than sulphate of ammonia, the season being a dry one.

4. That at least 2 cwt. nitrate of soda could be advantageously used for mangolds, even when 12 tons of dung per acre were applied.

5. That it is desirable to apply nitrate of soda as a top-dressing after the plant is singled out, and not to apply it at seed time.

6. That, if sulphate of ammonia is used, it should be sown with the seed, and not applied as a top-dressing.

It should, however, be particularly noticed that these conclusions are drawn from but one set of experiments, in an exceptionally dry season. In an ordinary season sulphate of ammonia sown with the seed might have acted quite as well as nitrate of soda. In such a case the relative market prices of the two articles would rule the farmer, it being remembered that $\frac{3}{4}$ cwt. of sulphate has the same nitrogenous strength as 1 cwt. nitrate. But as nitrate seems to give better results than sulphate in a dry season, and as it is not possible to foretell the quantity or distribution of a season's rainfall, these experiments seem to teach that it is safer, when the prices at all correspond,

to use nitrate. Possibly a combination—some sulphate at seed time, and some nitrate later on—would be even better.

Mr. Bernard Dyer conducted the scientific part of this enquiry, and made the various analyses required.

3. Royal Manchester, Liverpool, and North Lancashire Agricultural Society.

This Society has undertaken an extensive scheme of experiments, which are now in progress, but these being upon permanent pasture and grasses, there is at present nothing special to report.

4. Yorkshire Agricultural Society.

The scheme for experiments on swedes, put forward by the Royal Agricultural Society of England, was taken up by this Society. Three gentlemen in different districts conducted them on their farms, viz. :—

Mr. J. Watson, of Gardham, Cherry Burton.
Mr. J. Wightman, of Hampole Priory, Doncaster.
Mr. G. Wright, of Sigglesthorne Hall, Hull.

Mr. Watson occupies a fine wold-farm on a chalk subsoil; Mr. Wightman's land is on Magnesian Limestone; and Mr. Wright's farm is on the drift formation of Holderness.

Mr. Thomas Fairley, F.R.S.E., the Consulting Chemist to the Society, made the analyses of soils, manures, &c., in connection with the experiments, and generally directed them on the scientific side.

Mr. Fairley's analyses of the three different soils were:—

100 *Parts of Fine Soils dried at* 212° *Fahr. contain:*—

	Gardham.	Hampole	Sigglesthorne.
Silicious matter	78·35	86·17	88·05
Alumina	1·74	2·87	2·42
Oxide of iron	5·34	4·47	3·52
Lime	3·27	0·42	0·86
Magnesia	0·37	0·34	0·47
Potash	0·30	0·28	0·33
Chloride of sodium	0·94	1·03	1·08
Sulphuric acid	0·07	0·05	0·03
Phosphoric acid	0·28	0·13	0·09
Carbonic acid	1·98	0·54	0·69
*Organic matter and loss	7·36	3·70	2·46
	100·00	100·00	100·00
* Containing nitrogen	0 28	0·13	0·11
Equal to ammonia	0·34	0·16	0·13

These soils, it will be observed, are very different in character, and hence the selection of the *locale* of the experiments was a very happy one. The Gardham soil has an abundance of lime, of phosphoric acid, and nitrogen, and is evidently a rich soil. The Sigglesthorne soil is, on the contrary, one in poor condition, and the Hampole stands intermediate.

Inspections of the experiments have been made by members of the Local Society's Committee, and observations were recorded on the appearances shown at different periods. These will be found on referring to the detailed report issued by the Experiments Committee of the Yorkshire Agricultural Society.

(*a.*) Experiments on Swedes at Gardham grown on Wheat-Stubble after a Fallow.

The soil was a rich loam on chalk, and, as observed, the land was too rich to serve well the purposes of an experiment and

Swedes at Gardham.

No. of Plot.	Manures per Acre.	Yield of Roots on each quarter of a Plot.				Yield per Acre.				Increase per Acre over average of Unmanured Plots.			
		tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
1	12 loads of dung	3	12	3	0	14	11	0	0	0	14	0	0
1A	12 loads dung, 3 cwt. superphosphate, 2 cwt. Peruvian guano ..	3	19	2	0	15	18	0	0	2	1	0	0
2	6 loads dung, 4 cwt. superphosphate	4	6	2	0	17	6	0	0	3	9	0	0
2A	6 loads dung, 4 cwt. dissolved bones	3	17	1	0	15	9	0	0	1	12	0	0
3	4 cwt. superphosphate, $1\frac{1}{2}$ cwt nitrate of soda	4	0	0	0	16	0	0	0	2	3	0	0
4	4 cwt. superphosphate, $1\frac{1}{2}$ cwt. nitrate of soda, 2 cwt. sulphate potash	3	9	0	0	13	16	0	0	less	1	0	0
5	*Nothing*	3	7	2	0	13	10	0	0	less]			
6	4 cwt. ground coprolites	2	6	1	0	9	5	0	0	4	12	0	0
7	*Nothing*	3	11	0	0	14	4	0	0		..		
8	4 cwt. superphosphate	4	0	0	0	16	0	0	0	2	3	0	0
9	4 cwt. superphosphate, $1\frac{1}{4}$ cwt. sulphate ammonia	4	5	1	0	17	1	0	0	3	4	0	0
10	4 cwt. superphosphate, $1\frac{1}{4}$ cwt. sulphate ammonia, 2 cwt. sulphate potash	4	0	0	0	16	0	0	0	2	3	0	0
11	4 cwt. superphosphate, 2 cwt. sulphate potash	4	0	0	0	16	0	0	0	2	3	0	0
12	6 loads dung, 4 cwt. superphosphate, $1\frac{1}{2}$ cwt. nitrate of soda	4	3	0	0	16	12	0	0	2	15	0	0

allow the application of further manures to tell. The produce from the unmanured plots was high—12 loads of dung per acre added 14 cwt. only to the crop: 4 cwt. superphosphate, used alone, gave an increase of 2 tons 3 cwt. per acre, and the largest yield was obtained by the use of superphosphate with 6 loads of dung. Ground coprolites involved actual loss, and it is evident that on such land in Yorkshire, superphosphate is evidently the manure to use. The addition of potash manures has caused no benefit, and they were evidently not required. Sulphate of ammonia did better than nitrate of soda here.

The results are given on page 269.

(*b.*) Experiments on Swedes at Hampole after Barley.

The soil of the experimental field consists principally of a deep and rather strong loam on a clay subsoil, except at the upper side next the road, where the Magnesian Limestone forms the subsoil, and the soil is rather lighter and thinner in character. The land varies considerably, a weak patch crossing most of the plots; this is a difficulty which is experienced generally in carrying out experiments, and one reason why repetition is so desirable. The results are given on page 271.

The duplicate unmanured plots were very fairly alike, and the influence of the different manures told considerably. Most striking is the superiority shown by superphosphate over ground coprolites, as was also the case at Gardham. At Hampole, however, dissolved bones used with dung have shown rather better results than superphosphate. Also, sulphate of potash used with either nitrate of soda or sulphate of ammonia has on this less rich soil shown to advantage, the best result on the whole being derived from a combination of artificial manures including superphosphate, nitrate of soda, and potash in some form. It would be interesting to experiment and see in what form and in what quantity potash is best applied on such land. Artificial manures have shown most favourable results as compared with dung, though it must be borne in mind that the more durable nature of the latter has also to be considered.

(*c.*) Experiments on Swedes at Sigglesthorne, Hull.

The soil is a strong loam, resting on a clay subsoil, and there was difficulty in getting a proper tilth. The field has been in a very exhausted state, beans and oats without manure having been grown.

The results are given on page 272.

Swedes at Hampole, near Doncaster.

No. of Plot.	Manure per Acre.	No. of Roots on each ¼-acre Plot.	Weight of Roots on each ¼-acre Plot.				Weight of Tops on each ¼-acre Plot.			Weight of Roots per Acre.				Tops per Acre.				Excess of Roots over Average of Plots. No Manure.			
			tons	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
1	12 loads dung	4916	3	9	0	0	7	3	0	13	16	0	0	1	11	0	0	6	6	1	8
1A	12 loads dung, 3 cwt. superphosphate, 2 cwt. Peruvian guano	4814	4	9	1	7	6	1	10	17	17	1	0	1	5	1	12	10	7	2	8
2	6 loads dung, 4 cwt. superphosphate	5106	3	13	0	0	6	1	26	14	12	0	0	1	5	3	20	7	2	1	8
2A	6 loads dung, 4 cwt. dissolved bones	4999	3	19	3	1	7	1	0	15	19	0	4	1	9	0	0	8	9	1	12
3	4 cwt. superphosphate, 1½ cwt. nitrate of soda	4446	3	8	0	7	6	0	0	13	12	1	0	1	4	0	0	6	2	2	8
4	4 cwt. superphosphate, 1½ cwt. nitrate of soda, 2 cwt. sulphate of potash	4866	4	6	2	24	5	3	4	17	6	3	12	1	3	0	16	9	17	0	20
5	*Nothing*	4471	1	19	2	3	4	0	6	7	18	0	12		16	0	24				
6	4 cwt. coprolites	4412	2	3	3	13	4	1	8	8	15	1	24		17	1	4	1	5	3	4
7	*Nothing*	4159	1	15	1	17	4	1	17	7	1	2	12		17	2	12				
8	4 cwt. superphosphate	4752	3	4	3	14	6	3	2	12	19	2	0	1	7	0	8	5	9	3	8
9	4 cwt. superphosphate, 1¼ cwt. sulphate of ammonia	4521	3	4	2	7	7	1	8	12	18	1	0	1	9	1	4	5	8	2	8
10	4 cwt. superphosphate, 1¼ cwt. sulphate of ammonia, 2 cwt. sulphate of potash	4457	3	19	2	7	7	1	1	15	18	1	0	1	9	0	4	8	8	2	5
11	4 cwt. superphosphate, 2 cwt. sulphate of potash	4414	3	4	2	14	6	2	2	12	18	2	0	1	6	0	8	5	8	3	8
12	6 loads dung, 4 cwt. superphosphate, 1½ cwt. nitrate of soda ..	4521	3	13	3	7	9	1	0	14	15	1	0	1	17	0	0	7	5	2	8

SWEDES at SIGGLESTHORNE near HULL.

No. of Plot.	Manure per Acre.	Cost of manure per Acre. £ s. d.	No. of Roots on each Plot.	Weight of Roots per Acre. tons cwt. qrs. lbs.	Increase per Acre over Average of Unmanured Plots. tons cwt. qrs. lbs.
1	12 loads of dung, at 6*s.* a load	3 12 0	3713	9 0 3 0	6 2 3 14
1A	12 loads of dung, 3 cwt. of superphosphate, 2 cwt. Peruvian guano	4 17 9	3545	12 0 3 2	9 3 1 14
2	6 loads of dung, 4 cwt. of superphosphate	2 11 0	3855	10 16 0 0	7 15 3 14
2A	6 loads of dung, 4 cwt. of dissolved bones	3 0 0	3471	10 16 0 14	7 16 0 0
3	4 cwt. of superphosphate, 1½ cwt. of nitrate of soda	1 10 0	3753	10 10 0 0	7 9 3 14
4	4 cwt. of superphosphate, 1½ cwt. of nitrate of soda, 2 cwt. of sulphate of potash	2 2 0	3693	11 8 0 0	8 7 3 14
5	*Nothing*	..	3804	3 14 1 0	.. ..
6	4 cwt. of coprolites	0 14 0	3672	6 10 0 0	3 9 3 14
7	*Nothing*	..	3325	2 6 0 0	.. ..
8	4 cwt. of superphosphate ..	0 15 0	4102	8 9 2 0	5 9 1 14
9	4 cwt. of superphosphate, 1¼ cwt. of sulphate of ammonia	1 10 0	4167	10 1 0 0	7 0 3 14
10	4 cwt. of superphosphate, 1¼ cwt. sulphate of ammonia, 2 cwt. sulphate of potash ..	2 2 0	3995	8 14 0 0	5 13 3 14
11	4 cwt. superphosphate, 2 cwt. sulphate of potash	1 7 0	3812	7 10 0 0	4 9 3 14
12	6 loads of dung, 4 cwt. superphosphate, 1½ cwt. nitrate of soda	3 6 0	3988	12 10 1 0	9 10 0 14

These experiments are probably the most valuable of the series, from the fact that the land was in the poorest condition manurially, and hence the action of the different dressings is more apparent. The mechanical condition, owing to the much stiffer nature of the land, and the great difficulties of preparing a tilth, in consequence of a wet and very backward spring, accounts for the irregularity of the plants, and the smaller number of roots on each plot.

Superphosphate for the third time in these Yorkshire experiments has proved itself superior to ground coprolites, and so far as that part of the country is concerned, there can be left but little doubt on the question of dissolved *versus* undissolved phosphates. Either nitrate of soda or sulphate of ammonia have given with superphosphate a rather more economical return than the latter mixed with six loads of dung. Dung, used alone, has not had a high result, and the use of artificial manures with a small quantity of dung would appear to have been, on land in such condition as this, the most profitable manuring to

employ. There is no decided reply as to the use of manures containing potash.

The results, in brief, of the Norfolk experiments point to the profitable employment on certain soils, for both barley and root crops, of manures comprising potash in their composition, and show also that on some soils the application of potash can become a *sine quâ non.*

The results of the Essex experiments point to the superiority of nitrate of soda to sulphate of ammonia in a dry season, as a manure for mangolds, and that it should be sown as a top-dressing, while sulphate of ammonia is better sown with the seed. Further, that even where 12 tons of dung have been used per acre, soluble nitrogenous manures to the extent of as much as 2 cwt. per acre of nitrate of soda can be profitably used on such soil, together with superphosphate.

Lastly, the Yorkshire experiments are specially valuable, by reason of the clear answer they give to the vexed question of dissolved *versus* undissolved phosphates.

IX.—*Mustard Beetles.* (Abstract of the information forwarded in reply to the circulars issued by the Royal Agricultural Society.) By MISS ELEANOR A. ORMEROD, Consulting Entomologist of the Royal Agricultural Society.

THE replies received during the past season in answer to the circulars issued by the Royal Agricultural Society regarding the attack of the Mustard Beetle, and the means found serviceable in lessening the amount of its ravages, have elicited a good deal of useful practical information from some of our leading mustard-growers; and, besides the special points under investigation, have clearly shown that the mischief to the mustard plant, usually ascribed in a general way to the so-called mustard beetle, is by no means entirely caused by this one kind. Just as the mustard beetle extends its ravages at pleasure to crops and weeds of the nature of cabbage, charlock, and the like, so do various kinds of beetles which attack these and other plants of the cabbage tribe, prey more or less seriously on mustard; and the knowledge of the kinds, which are thus injurious, brings the subject of insect injury to mustard much more within the regular bounds of ordinary agricultural treatment.

The beetle, which is especially known as *the* mustard beetle,

is the *Phædon betulæ*, Linn., formerly known as *Chrysomela betulæ* (Fig. 1, natural size and magnified). It is oblong-oval,

Fig. 1.—*Mustard Beetle* (Phædon betulæ).

1, 2, 4, larva (natural size) on leaf; 5, larva (magnified); 6, beetle, natural size; 7, beetle, magnified.

hardly the sixth of an inch in length, of a full blue or deep greenish colour above, and so brightly shining as to be of an almost glassy lustre. The legs, horns, and body beneath are black. The thorax or fore-body is very minutely punctured, the wing-cases having punctured striæ, with the spaces between the striæ also punctured.

These beetles pass the winter in a torpid state, in any convenient shelter near the fields where they have been in the autumn. In the spring they become active again, and spreading to whatever food-plant may be near, they lay their small eggs and die.

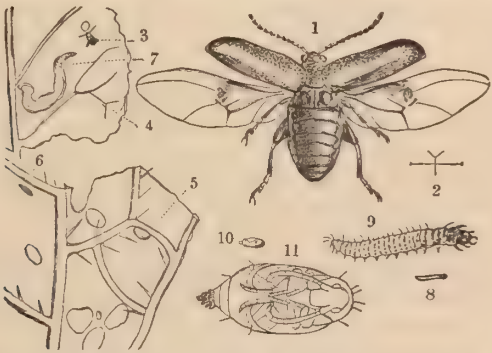
The grubs, or larvæ, which hatch from these eggs,* are of the shape shown in Fig. 1, and are from about three-sixteenths to a quarter of an inch in length when full grown, slightly hairy, of a smoky colour, spotted with black, with black heads and stout black conical horns, lighter at the base. They have three pairs of claw-feet, and a caudal foot, or proleg, at the end of the tail, and a row of tubercles along each side, from which the grubs have the power of protruding a yellow gland. These voracious grubs devour far and wide, until when full fed they go into the ground to change to chrysalids. In this state they are said to remain about fourteen days, and from these chrysalids the summer brood of beetles comes out which often spreads devastation over the mustard crop, then in an advanced state.

* I have identified the grub from specimens kindly procured for me by Mr. George Moore, of Wisbech from mustard plants near Ely, which enabled me to trace the insect from larval condition up to its perfect state, and confirm the figure and description given (doubtfully) by John Curtis in his 'Farm Insects' as being certainly that of the larva of the *Phædon betulæ*.—E. A. O.

The observations of the past season have also proved that, besides the injury caused by the true mustard beetle, much harm is done to the mustard plant by various kinds of turnip- "fly," or flea beetles, which attack it as they do the turnip-plant, whilst still in its first or early leafage. Those who are unacquainted with these beetles may readily distinguish them from the mustard beetles by their being much smaller, and also by their prodigious powers of leaping, and commonly by their having a yellow stripe running down the middle of each wing-case.

The species which has occurred most plentifully amongst those forwarded has been the *Haltica* (*Phyllotreta*) *undulata*, which differs so slightly from the *P. nemorum*, of which a figure

Fig. 2.—*Turnip-Flea Beetle* (Haltica (Phyllotreta) nemorum).



1, beetle, magnified; 2 and 3, natural size; 4 and 5, eggs; 6 and 7, burrows made by the maggots; 8 and 9, larva, natural size and magnified; 10 and 11, pupa, natural size and magnified.

is given (Fig. 2, which, with Fig. 4, is inserted by permission of Messrs. Blackie & Son, of Glasgow), that the two kinds can hardly be distinguished by the naked eye. Both have a yellow stripe along the wing-cases. The turnip-flea beetles pass the winter under clods or rubbish, or in any convenient nook, and, like the mustard beetles, come out in spring to feed on the same class of plants as these, and to lay their eggs on the leaves.

Later on, in the growth of the mustard plant, just when it is knotting for flower, the opening buds and blossoms are very often attacked by large numbers of the turnip-blossom beetle, the *Meligethes æneus.* This is a small beetle (Fig. 3), of much the same shape as the mustard beetle, and, as far as I gather, it is frequently taken for it, but it is distinguished by its much smaller size, being little more than one-twelfth of an inch in length, and commonly of a duller or more brassy green than the true mustard beetle.

These beetles attack various plants of the cabbage tribe. They lay their eggs in the opening buds or blossoms, and the

Fig. 3.—*Turnip-blossom Beetle* (Meligethes æneus).

Beetle magnified, and natural size on flower; larva and jaws, and antennæ of larva, mag.

grubs, or larvæ, which hatch in a few days, feed on various parts of the flower. Later on the grubs disperse on the flower-stalks and the seed-pods, where they gnaw the surface. At first the grubs are whitish, with a broad purple head and purple markings; later on they are yellowish-white. When full fed they fall down, and turn to chrysalids in the ground. The period occupied from the first laying of the eggs to the first observation of chrysalids was from the 8th of June to the 7th of July.

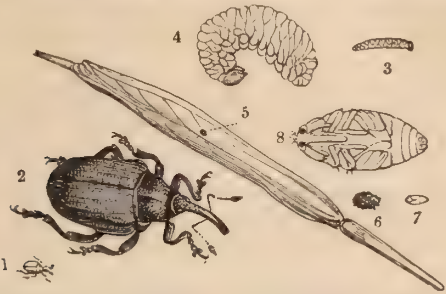
The above remarks are taken from my own observations of the habits of Meligethes on rape.* They have been found in great numbers on mustard during the past season; and there is every reason to suppose, from the methods of attack mentioned, that they have been present in previous years on this crop, but I am not aware that the fact has been recorded. In 1881, the year of the great turnip-fly attack, Meligethes were also very destructive in some parts both of England and Scotland. To give one example of their powers, it may be mentioned that at Thruxton, Hants, the seed-crop of an eighteen-acre field of rape was entirely ruined by them. The Meligethes beetles are stated to winter in the ground, and to come out again in April; likewise to have great powers of flight.

Besides the above-named beetles, a small dark-grey long-snouted weevil, the *Ceutorhynchus assimilis*, Payk., commonly called the turnip-seed weevil (Fig. 4), is also to be found accompanying the flower-beetle on the blossoming heads. This weevil destroys the seeds of various plants of the cabbage tribe, when they are formed in the pods; and from the state of some seed, both of brown and white mustard, sent me, there was every appearance of it having been at work; but I had not the

* "Observations on Meligethes" in 'Entomologist's Monthly Mag.,' 1874.

opportunity of observing more than its presence. The three other kinds above noted are seriously destructive.

Fig. 4.—*Turnip-seed Weevil* (Ceutorhynchus assimilis).



1 and 2, weevil, natural size and magnified; 3 and 4, maggots, magnified; 5, turnip-seed pod pierced by maggot; 6, cocoon; 7 and 8, pupa, natural size and magnified.

The reports forwarded gave, in addition to the direct replies to the enquiries in the circulars, observations from various localities, accompanied by plentiful supplies of specimens of the above-mentioned insects, and some other kinds less frequently met with, also noticed on mustard; but as these reports run to greater length than space will permit, I can only at present offer an abstract of the main points of the information received, together with a list of the contributors.*

The following abstracts of information are classed under the headings of the enquiries in the circulars, to which they are replies:—

Where Attack comes from.

1. Where do the beetles which start the spring attack shelter in the winter? As—down old mustard-straw; in straw used for rough thatch, &c.; down pipes of reeds; or in rubbish generally?

The beetles are stated to lie dormant during the winter in pipes or reeds; in the ends of old mustard-stocks left on the land; and likewise in the root-ends of mustard-stubble, which is left on the land when the crop is cleared, and they may be found lying on the land all the following winter in the young wheat. "As many as twelve beetles have been found in one of these stubble-roots;" they shelter during winter in mustard-stacks and temporary walls formed of mustard or other straw. They also winter in crevices of old wood; between the bark and the wood of old decayed trees; in cracks of gates, of gate-

* The notes sent will be published *in extenso* as a separate paper in my own 'Annual Report on Injurious Insects,' now preparing.—E. A. O.

posts, and of posts, rails or farm buildings. They are to be found in rough grass and rushes which grow by the side of marsh-ditches, and also in the earth at the bottom of the hedge-rows of fields in which mustard has been grown the previous year, likewise in the earth of drain-banks. They also shelter "in all kinds of rubbish," in "heaps of rubbish"—"in anything that will shelter them."

As is the case with many other insects, the winter cold does not appear to injure them so long as they continue to lie in the shelters, which they have themselves chosen. It is stated,

"they seem quite indifferent to frost, for though when you open the stalk they seem dead, they soon begin to move. Many of these stalks lying on the top of the land have been exposed to all the frosts of last winter."

Likewise that,

"they will live through the most severe winter in the pipes of the reeds and rushes in ditches and drains."

Are beetles brought in seed?

Beetles are stated

"to be frequently found in the seed when freshly threshed, but do not appear to remain long after;"

although a note is given of their being

"found alive in sacks for two years after the seed has been threshed out."

Other notes mention that the beetles have not been found, or have rarely been found, in seed; and that if they were so found, the use of the common vitriol steep for wheat would destroy them.

2. Upon what weeds or crops do the beetles feed till the mustard is ready for them? As—charlock, and the like; or brook-lime, and other weeds found by ditches?

"In the spring you may find them on any kind of charlock, or pieces of mustard that may be about."

Another observer says that

"he is not aware of any plant they feed on earlier than mustard. Charlock comes about the same time as early sown seed. . . . ."

No mention is made of any plant being attacked earlier than mustard. In one report white mustard is noted as attacked by preference, then garden cabbage and horseradish.

The list of plants regularly attacked comprises cabbage, kohl-rabi, cress, horseradish, and others of the Cruciferæ, or cabbage tribe.

3. Any information on the above or similar points, and treatment found useful in such circumstances, or on the use of steeps to kill beetles if found amongst seed, would be very useful.

No replies were received either as to getting rid of chance food-plants or the use of steeps.

Means of Preventing Attack, or of Lessening the Amount, by Agricultural Measures.

4. Dates of sowing; methods of cultivation and of preparation of the land found to answer in pushing the plant-growth on past harm from common amount of attack.

One correspondent mentions that the dates of sowing are:

"in Cambridgeshire, February to March; in Lincolnshire, March to April."

The special dates given are:

"the latter part of February or the beginning of March, 5th to 15th of March, 20th of March to 6th of April, late in March or early in April."

Early sowing is advised, to get the plant well on before the beetle attack begins.

Methods of Cultivation, &c.

"The land should be in very good heart (newly broken up land is undoubtedly best), it should be well manured in the winter, well worked and rolled down until solid before the seed is drilled, and again rolled after the drill. The seed should be drilled with superphosphate; if with a water-drill, so much the better."—W. A.

"I have lately grown about forty acres per annum, about half of which was summer fallowed in the previous year, and dressed with farmyard-manure in the ordinary way. The other half has usually been taken after wheat on land in good manurial condition. . . . As soon as the wheat last year was harvested, the land was twice steam-cultivated, then left until February, when it was ploughed over; then left until the middle of April, when it was well harrowed and drilled 16 inches apart with about 6 lbs. of white mustard-seed per acre. . . . When I have thought it necessary, I have drilled 4 to 5 cwt. superphosphate or dissolved bones to push on the plant in its early stage."—T. E. J.

"Make a clean summer fallow, manure it with a large quantity of unrotted farmyard or stable manure; set it up in 4-yard lands, plough in deeply, and water-furrow and grip the field as though for wheat. Leave it until the spring frosts are well over, and the land dry enough to carry the horses without treading, and then harrow, with sharp-tined light harrows,—the fine winter mould gives an excellent seed bed. Drill in clean bright seed, not too deep, say 1 inch only, and cover with seed harrows, without rolling; 4 lbs. of good seed should be sufficient if it is a satisfactory tilth."—R. L.

"Sow on summer fallow, well mucked and scarified and harrowed."—C. C. H.

"I believe that early sowing and liberal manuring give the plants the best chance of escaping serious damage."—W. C. L.

The observations regarding direct measures of cultivation all agree in the importance of thoroughly-prepared and well-manured soil, for the most part cleaned from weeds by summer fallowing, but sometimes as a succession to broken-up grass, in which case the customary freedom of mustard from wire-worms would be an additional reason for saving this crop. But beyond this, and looking to the fact established by last year's observations that serious mischief to mustard in its early stage is caused by the common turnip-flea beetle, it occurs to me whether some of the more special treatment, used by our best turnip-growers to counteract the ravages of the flea-beetle on the seed leaves of turnips, might not be equally useful in saving mustard.*

Temporary discontinuance of Mustard-Growing a means of clearing infected Districts.—Where a district has become infested by the mustard beetle the only sure method of getting rid of the insect is considered to be the combined action of the farmers not to grow mustard for a time; or, where the attack is less widely spread, to cease growing the crop for a while on infested farms.

This point (of discontinuance) is very strongly urged by the reporters. To be a complete cure, it is also desirable to discontinue the growth of cabbage and other allied plants on which the beetles feed, though the following observation shows that this is not essential for general practical benefit:—

"The only thing to be done when a farm becomes infested with the pest is to discontinue the growth of mustard for a few years. This has been found to answer. Though the insects live on other plants they constantly diminish in numbers, and almost entirely disappear in the course of two or three years if there is no mustard in the immediate neighbourhood."—W. C. L.

5. What manures have been found serviceable? Is gas-lime used?

Superphosphate of lime, and dissolved bones, and "any rich manure." Artificial manures are necessary to secure a crop on

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* In my reports published in 1881 regarding methods of cultivation found most suitable for pushing on a healthy rapid growth of the turnip-plant, and so carrying it from under the power of the "fly," great stress is laid by the contributors on so treating the land by autumn cultivation, that when the seed is sown in spring a good tilth is secured of the fine soil, broken down by the winter frosts, which is kept on the surface by the use of scarifiers. This operation is all that is requisite under the circumstances, as the previous thorough cultivation makes a spring ploughing unnecessary. Thus instead of a soil which has been exposed and dried in the course of ploughing, and reduced to requisite fineness, there is a good tilth on the surface, forming a first-rate seed bed, free from the clods which are a special shelter to "fly," while below the surface there is a soil in excellent state, both as regards cultivation and manurial condition, but still not robbed of the store of moisture which aids materially in pushing on the plant past attack.—E. A. O.

old broken-up land. An instance of this was given in a crop to a part of which none was used, owing to the application of a heavy dressing of farmyard-manure.

"This was not half the value of the rest of the field. . . . Proctor and Ryland's special mustard manure is very serviceable, the object *being to promote a healthy and rapid growth* out of the way of the insects."

Nitrate of soda is stated to have been used without good results, and gas-lime also is mentioned as not found to be of much use.

MEASURES FOR DESTROYING THE BEETLES OR THEIR GRUBS.

6. Is there any kind of treatment found useful in getting rid of the grubs, such as dressing with lime or other applications when the dew is on? Or are any measures of service when the grubs go down into the soil for their change, such as hand- or horse-hoeing which would throw the chrysalids out, or lay them open to such birds as may eat them? Information would be particularly desirable as to any methods of destroying the beetles on the plants (if any such are known), or of checking their progress when advancing in bodies. Notes as to checking progress by fire, or by making a trench in front of the advance and killing the beetles in it, or by any other means, would be very acceptable.

Quick lime, dry lime, soot, sulphur, and salt are mentioned as having been tried without any effect in stopping ravages. Likewise Jeyes' Fluid, Condy's Fluid, and rock oil have been sprinkled without any good results. A note is given of carbolic acid, used strong enough to kill the plants, only killing about 10 per cent. of the beetles.

Ploughing in a ruined crop at once has been found of use—in autumn to prevent the migration of the beetles on it to other neighbouring crops, and in spring to destroy the beetles, and to bury the plants with the beetle-eggs on the remains of the leaves, as these eggs would otherwise start a new attack.

Burning the mustard straw and chaff was stated to be desirable where the insects are numerous.

Use of burning Straw or Stubble and of Tar to check advance of Beetles.—Notes are given from several localities of burning straw (especially damp straw) in front of the line of march of the beetles when they are moving in large bodies as being of use in checking advance, and thus saving the crop to which they are migrating, the fires being lighted to windward so as to drive the smoke on to the beetles. Two loads of short damp straw

spread in a line 150 yards long and fired, are mentioned by one observer as having stopped further progress. Also,

"their progress has been stopped completely by burning damp straw in a gateway through which they were passing."

It is observed

"that at this period they make little use of their wings."

A note was also sent of the advance of a migrating horde being checked "by making a shallow trench and filling it with cold tar." The beetles got into the tar and were unable to extricate themselves.

Use of Elder Boughs.—

"Brushing with elder boughs fixed on a hurdle and drawn by a horse over the young plants, is useful, as is hoeing or rolling. These measures act as a check to the work of the beetles."—W. A.

Shaking Beetles Off and Destroying them.—The German method of clearing beetles by shaking them off the plants into pails or any other convenient vessels and destroying them has been tried by two observers. One reports it to be expensive and not of use, while the other states that by keeping two men regularly at work at the operation, it so far answered that he considered that he thus saved his crops from being destroyed. Where this plan is tried the shaking or picking should be done early in the morning or on dull days when the beetles are sluggish.

General Information.

7. As to effects of weather; to the rotation of crops; to the neighbourhood of previously infested land; in fact, as to any of the points which are known to mustard-growers as bearing on the subject, would all be of service. Any observations as to whether wireworms were found in mustard fields, or attacked wheat or other crops succeeding mustard, would also be of much interest.

The small amount of information forwarded in reply to the first enquiries is for the most part given under the preceding headings. With regard to wireworms, almost all the contributors who have sent replies agree in the serviceableness of mustard in clearing land of this pest sufficiently to secure the safety of the following crops.

Wireworms.—It is noted as being a good system to grow white mustard on land infested with wireworms, and an instance is given of a piece of land on which, when successive crops had failed through wireworms, white mustard was sown one year and a good crop of wheat obtained the next.

Also that

"mustard is considered a very excellent preparation for wheat, as it has a tendency to destroy or prevent the ravages of wireworms."—S. E.

With this, similar information to the above is given of land infested with wireworms having been put under mustard, and wireworms since being rarely met with, and wheat quite uninjured. Other notes are given, mentioning the sowing of white mustard as a regular practice to clear infested fields. Likewise of wireworms not being seen or heard of as attacking crops of wheat or other cereals after mustard; and that it seldom attacks any crop after mustard; also of wireworms not having been observed in mustard-fields.

That mustard is *not* always exempt is shown by the following observations.

"I think it is a common thing to find mustard attacked by wireworms, but only on land which is subject to the pest. I have a marsh of mustard destroyed by wireworms, and when ploughed and sowed with mustard it met the same fate."—E. S.

A very precise detailed account is also given of severe injury to a potato-crop caused by wireworms, and the subsequent destruction by them of 95 per cent. of the seed of mustard put into the ground with a view to clear the pest. In this case the wireworms attacked the germ as soon as it showed signs of vitality.

The above notes convey the main points of the information placed in my hands in reply to the circulars of the Royal Agricultural Society, but in such a condensed form that, in offering my thanks to those who have entrusted me with their observations, I desire to add that their communications will be given, almost in their own words, in my own 'Annual Report on Injurious Insects,' in which the requisite space can be afforded. Meanwhile I have, in the case of the longest quotations, appended to each the initials of the contributors, of whom a list of the names is also added.

LIST OF CONTRIBUTORS.

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REED, Col., Lancelot, Elm, near Wisbech.
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X.—*Report on the Field and Feeding Experiments at Woburn, conducted on behalf of the Royal Agricultural Society of England during the year* 1886. By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., Consulting Chemist to the Royal Agricultural Society.

EXPERIMENTS ON THE CONTINUOUS GROWTH OF WHEAT.

IMMEDIATELY after harvest, 1885, the experimental plots were forked, and any twitch removed. They were ploughed in the beginning of October, and harrowed immediately afterwards.

Next they were rolled, and marked out with the drill, and Browick wheat, at the rate of 9 pecks per acre, was dibbled in on October 14th–19th. The mineral-manures were sown and harrowed in on plots 4, 5, 6, 8 and 9, and by November 7th the plant began to show above ground and came up well on all the plots. On November 16th the feeding of four 3-year-old Hereford bullocks to make the farmyard manure for the plots 10 B and 11 B commenced. They were weighed and put in the feeding boxes, where they were kept until December 7th, when they were again weighed. During the 21 days they consumed:—

2 cwt. 2 qrs. decorticated cotton-cake.
4 cwt. maize-meal.
31 cwt. 2 qrs. 16 lbs. swedes.
6 cwt. wheat-straw chaff as food.

They were further supplied during the time with 12 cwt. wheat-straw as litter.

At first the bullocks had 3 lbs. decorticated cotton-cake, 5 lbs. maize-meal, 40 lbs. swedes, 7½ lbs. wheat-straw chaff per head daily, but later on the swedes were increased to 45 lbs. and the chaff to 9 lbs. The quantity taken at starting was rather more than in former years, the bullocks being older than those used

previously. The weights at the commencement and end of the period of feeding were :—

	Put up, Nov. 16th.			Removed, Dec. 7th.			Gain in Live-Weight in Twenty-one Days.		
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Bullock No. 1	9	1	23	10	0	17	0	2	22
" No. 2	8	3	14	9	2	10	0	2	24
" No. 3	10	3	14	11	1	3	0	1	17
" No. 4	9	0	14	9	3	21	0	3	7
Total weight of 4 Bullocks ..	38	1	9	40	3	23	2	2	14

The increase, it will be seen, was a satisfactory one. The composition of the foods employed was as follows :—

	Decorticated Cotton-cake.	Maize-meal.
Moisture	10·45	13·15
Oil	15·60	4·57
*Albuminous compounds	42·84	9·31
Digestible fibre, starch, &c.	20·99	62·44
Woody fibre	3·07	8·73
Mineral matter	7·05	1·80
	100·00	100·00
* Containing nitrogen	6·85	1·49

The swedes contained nitrogen—

First lot used .. .. ·27 per cent.
Second lot used .. .. ·18 "
The wheat-straw contained nitrogen ·45 "

The decorticated cotton-cake, it will be seen, was of good quality and rich in oil.

The dung after removal from the pits was kept under cover until February 26th, 1886, it then weighing 30 cwt. 7 lbs. Plots 10 B and 11 B, were on the same day dressed with the dung in quantity sufficient to supply to them respectively 100 lbs. and 200 lbs. ammonia per acre.

The winter was altogether a most unfavourable one, and the occurrence of repeated frosts in the early spring tended to produce but a poor plant of wheat; especially was this the case upon the unmanured portions. Plot 10 B also looked very poor. Towards the middle of March it began somewhat to recover,

but all through plot 10 B the plant was thin. Wireworms had further made some ravages, especially on plots 1, 2, and 3. Top-dressings of ammonia-salts and nitrate of soda were sown on plots 2, 3, 5, 6, 8 B, 9 B, on April 22nd, in the usual way, viz., by a broadcast manure distributor, after being mixed with three times their quantity of dry sand. The plots were then pressed with a Cambridge roller and harrowed. Any gaps left were filled in during this month. Hoeing was commenced towards the end of April. On May 8th an inspection of the plots showed that 8 B and 9 B looked decidedly the best of all, 5 and 6 being next in order. Of these the nitrate of soda plots looked rather the better. Nos. 1, 2, and 3 were very backward, while No. 4 (minerals only) seemed better than the unmanured plots. There was at this period no difference to speak of between the plots which had received the heavy and the light dressings of dung respectively. Of the duplicate unmanured plots, No. 1 was poorer than No. 7, and the plant was thinner on it. On May 27th, plot 1 (unmanured) was decidedly the poorest, and inferior to the duplicate (unmanured) No. 7.

A great deal of rain had fallen about this time and the ground was in a very wet state. The nitrate of soda plots, 6 and 9 B, had by this time gone considerably ahead of the corresponding ones manured with ammonia-salts; in each case the more heavily-manured plots had the advantage; the influence of the heavier dressing of dung on 11 B had also begun to tell. Plot 4 (minerals only) was much the same as the unmanured plot No. 7. Plot 2 (ammonia-salts alone) was still very thin, and No. 3 (nitrate of soda alone) was decidedly better.

At the beginning of July the relative positions were very similar, the nitrate of soda plots showing a marked ascendency. Plot 6, though perhaps not the heaviest, looked on the whole the best plot on the field. Where nitrate of soda and ammonia-salts were omitted (8 A, 9 A) for the single year, the appearance of the crops was not better than on No. 7 (unmanured). The withholding of the dung in the case of 10 A and 11 A made them hardly better than 7 (unmanured), but the small quantity of dung (4 tons) also showed very little resulting benefit.

The harvest was considerably delayed by continued wet weather in August, but plots 7 and 11 A were cut on August 25th, and the remaining plots on August 31st, all being carted and stacked in the field on September 1st.

The wheat was threshed in the field, October 20th; the straw was weighed at once, and the corn a few days later. The results are given in Table I.

The produce, doubtless owing in great measure to the unfavourable winter and the prevalence of early frosts, has been

TABLE I.—PRODUCE OF CONTINUOUS WHEAT. TENTH SEASON, 1886.

Plots.	Manures per Acre.	Produce per Acre.					
		Dressed Corn.			Straw, Chaff, &c.		
		Weight.	Number of Bushels.	Weight per Bushel.			
		lbs.		lbs.	cwt.	qrs.	lbs.
1	Unmanured	688	12·2	56·2	11	3	7
2	200 lbs. ammonia-salts, containing 50 lbs. ammonia	917	17·0	53·94	12	1	8
3	275 lbs. nitrate of soda, containing 50 lbs. ammonia	1079	20·2	53·25	16	2	7
4	200 lbs. sulphate of potash, 100 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, 3½ cwt. superphosphate of lime	903	15·2	59·4	11	2	16
5	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwt. superphosphate of lime, and 200 lbs. ammonia-salts (in spring)	1279	21·7	58·9	17	1	25
6	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwt. superphosphate of lime, and 275 lbs. nitrate of soda (in spring) ..	1823	30·8	59·2	25	1	14
7	Unmanured	803	14·5	55·5	12	0	13
8A	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwt. superphosphate of lime ..	826	14·1	58·5	10	2	4
8B	The same minerals as in 8A, and 400 lbs. ammonia-salts	2084	34·8	59·94	27	0	2
9A	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwt. superphosphate of lime ..	896	14·93	60·0	12	1	16
9B	The same minerals as in 9A, and 550 lbs. nitrate of soda	1996	33·9	58·9	30	3	2
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882 or since)	930	16·2	57·4	11	3	8
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. ammonia, made from 672 lbs. decorticated cotton-cake, 1075 lbs. maize-meal, 8064 lbs. turnips, 1344 lbs. wheat-straw, as food; and 3174 lbs. wheat-straw as litter. Weight about 4 tons	1030	17·94	57·4	14	0	20
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882 or since)	928	16·6	56·0	13	2	6
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1344 lbs. decorticated cotton-cake, 2150 lbs. maize-meal, 16,128 lbs. turnips, 2688 lbs. wheat-straw chaff, as food; and 6348 lbs. wheat-straw as litter. Weight about 8 tons ..	1596	27·9	57·2	18	2	26

very low over all the plots—lower, indeed, than has been recorded since 1880. The unmanured plots yielded 12·2 and 14·5 bushels per acre respectively, as against 21·3 and 21·9 bushels last year; while the highest yields only amounted to 34·8 bushels on plot 8 B, and 33·9 bushels on plot 9 B, the corresponding plots in 1885 having produced 41·1 and 40 bushels. Nitrate of soda, as compared with ammonia-salts, has produced the better results, 17·0 bushels being given by 200 lbs. of ammonia-salts to the acre, when used alone, as a top-dressing, and 20·2 bushels by an equivalent amount of nitrate of soda. Used in conjunction with minerals, ammonia-salts in the same quantity raised the yield to 21·7 bushels, and nitrate of soda to 30·8 bushels. When both salts were used in double these amounts, and with minerals as before, the increase with ammonia-salts was 34·8 bushels, and with nitrate of soda only 33·9 bushels; in the case of the latter, however, there was more straw. Mineral manures alone only gave a slight increase, viz., to 15·2 bushels. As in previous years, omission of ammonia-salts or nitrate of soda for a single season reduced the produce virtually to the yield of the unmanured plots. The influence of farmyard-manure, applied at the rate of about 4 tons to the acre, was hardly perceptible, though, put on at the rate of about 8 tons to the acre, it gave 27·9 bushels. Where dung was last applied in 1881 the produce was 16 bushels only.

Experiments on the Continuous Growth of Barley.

The plots were forked and prepared for ploughing in the middle of September, 1885. The dung for plots 10 B and 11 B was made by four 3-year-old bullocks, at the same time and in a similar manner to that in which the dung for the wheat plots was made, the same amount and kinds of food being consumed during the twenty-one days of experiment. The weights at the commencement and end were as follows:—

	Put up, Nov. 16th.			Removed, Dec. 7th.			Gain in Live-Weight in Twenty-one Days.		
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Bullock No. 1	9	2	1	10	0	8	0	2	7
" No. 2	8	3	21	9	1	18	0	1	25
" No. 3	10	3	0	11	1	2	0	2	2
" No. 4	9	0	21	9	3	24	0	3	3
Total weight of 4 Bullocks ..	38	1	15	40	2	24	2	1	9

It will be noticed that the gain was very satisfactory and also very similar to that in the wheat lot. It may be of interest at this point to mention a by-experiment that was made, as there happened to be more bullocks on the farm, all of them belonging to one lot. The object was to see what difference there would be between the bullocks fed in the feeding boxes and others receiving exactly the same amount and kind of food, but allowed to run loose in the open yard. The weights of the four bullocks in the open yard at commencement and end were as follows: —

	Put up Nov. 16th.			Removed Dec. 7th.			Gain in Live weight in Twenty-one Days.		
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Bullock No. 1	9	1	4	9	3	23	0	2	19
„ No. 2	10	0	10	10	2	1	0	1	19
„ No. 3	9	1	18	9	3	21	0	2	3
„ No. 4	9	2	3	10	0	26	0	2	23
Total weight of 4 Bullocks ..	38	1	7	40	2	15	2	1	8

It will thus be seen that the increase in live weight was practically as much in the case of the bullocks in the open yard as in that of the box-fed animals.

	Feeding Boxes.						Open Yard.		
	Continuous Wheat Experiment.			Continuous Barley Experiment.					
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Total gain of 4 Bullocks during 21 days	2	2	14	2	1	9	2	1	8

The dung was kept under cover and weighed on March 5th, 1886, the total weight being 27 cwt. 3 qrs. 9 lbs. Plots 10 B and 11 B were supplied with the quantities requisite to provide 100 lbs. and 200 lbs. of ammonia per acre respectively. The plots were ploughed again and the dung turned in. The weather was very unfavourable for sowing, but this was finally done on April 10th, 9 pecks per acre of Golden Melon Barley being drilled. The mineral manures had been sown on plots 4, 5, 6, 8 A, 9 A, on the day previous. The barley began to show by May 1st, and the nitrogenous top-dressings were sown on plots 2, 3, 5, 6, 8 B, 9 B, on May 15th. Hoeing began on May 19th, and the barley progressed favourably, coming well into ear by

TABLE II.—PRODUCE OF CONTINUOUS BARLEY. TENTH SEASON, 1886.

Plots.	Manures per Acre.	Produce per Acre.					
		Dressed Corn.			Straw, Chaff, &c.		
		Weight.	Number of Bushels.	Weight per Bushel.			
		lbs.		lbs.	cwt.	qrs.	lbs.
1	Unmanured	997	19·2	51·9	12	1	9
2	200 lbs. ammonia-salts, containing 50 lbs. ammonia	1571	29·8	52·8	15	2	19
3	275 lbs. nitrate of soda, containing 50 lbs. ammonia	2025	38·4	52·75	21	0	27
4	200 lbs. sulphate of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. magnesia, 3½ cwt. superphosphate of lime	974	18·7	52·06	10	0	25
5	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwt. superphosphate of lime, and 200 lbs. ammonia-salts	1729	32·1	53·9	15	3	26
6	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulphate of magnesia, 3½ cwt. of superphosphate of lime, and 275 lbs. nitrate of soda	2149	40·2	53·45	22	3	14
7	Unmanured	917	18·2	50·4	9	0	20
8A	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwt. of superphosphate of lime ..	1404	26·54	52·9	15	0	24
8B	The same minerals as in 8A, and 400 lbs. ammonia-salts	2354	44·1	53·4	23	3	24
9A	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwt. of superphosphate of lime ..	1478	27·7	53·3	14	3	24
9B	The same minerals as in 9A, and 550 lbs. of nitrate of soda	2804	52·0	53·9	32	0	20
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882 or since)	1396	26·7	52·25	15	3	4
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. of ammonia, made from 672 lbs. decorticated cotton-cake, 1075 lbs. maize-meal, 8064 lbs. turnips, 1344 lbs. wheat-straw chaff, as food; and 3174 lbs. wheat-straw as litter. Weight about 4 tons	1022	19·37	52·75	11	1	16
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882 or since)	1334	25·75	51·8	15	1	14
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1344 lbs. decorticated cotton-cake, 2150 lbs. maize-meal, 16,128 lbs. turnips, 2688 lbs. wheat-straw chaff, as food; and 6348 lbs. wheat-straw as litter. Weight about 8 tons ..	1842	34·6	53·2	19	0	2

July 10th. The barley looked very well and was a good plant all over. On May 27th it was noticed that the nitrogenous manures had not as yet shown their influence to any extent, nor yet had the dung; shortly, however, the manures began to tell, and, as in the case of the wheat, nitrate of soda, whether used alone or with mineral manures, showed itself superior to sulphate of ammonia. The heavier dressing of dung also told to some extent, though not nearly in as marked a manner as in the case of the wheat. A little before harvest it was noticed that most of the plots were exceedingly short in the straw, and all (especially the heavily manured ones) ripened very badly. Harvest was delayed by continuous bad weather, but finally the barley was cut and harvested on August 31st—September 7th; threshed and weighed on October 20th–22nd. The results are given in Table II.

As in the case of the wheat, the produce was very low, the lowest, indeed, since 1879. The unmanured plots gave only 19·2 and 18·2 bushels respectively, as against 21·8 and 22·5 bushels in 1885, itself a year of lower yield than usual. Nitrate of soda (275 lbs. to the acre) gave 38·4 bushels, while ammonia-salts (200 lbs. per acre) produced 29·8 bushels. Minerals added to the above increased the crop to 40·2 and 32·1 bushels respectively; but mineral manures, used alone, gave no more than the unmanured plots. The nitrogenous manures, applied in double quantity and with minerals as well, produced the heaviest crops, viz., 44·1 bushels with 400 lbs. ammonia-salts, and 52 bushels with 550 lbs. nitrate of soda. Farmyard manure, except at the higher rate (8 tons per acre), did not have much effect. The heaviest yields were, as before, on plots 8 B and 9 B, but these were only 44·1 and 52 bushels, against 58·7 and 64·5 bushels in 1885. In the case of the barley, the omission for a single season of the nitrogenous manures, though reducing the produce enormously, did not bring it so nearly to that of the unmanured plots as was the case with the wheat crop.

The Rotation Experiments.

It will be borne in mind that, on the conclusion of the second 4-course rotation in 1885, an alteration of the original plan was made, in consequence of decorticated cotton-cake not having shown itself superior as a manure to maize-meal similarly used, with the object of testing if this was due to any over-fertility of the land. With a view of exhausting this, if existing, the four plots of each rotation were divided by a cross-path into 8 plots of ½-acre each. On four of these plots the rotation is continued as before, though the manurial treatment is not so heavy or so frequently repeated, while on the other four plots

the same crops are grown in rotation without manure, and carried off the land entirely. In this way it is believed the true differences of manurial value may be brought out, and the question of over-fertility settled.

Rotation No. 1.—Four acres. 1885, tares (2 acres); peas (2 acres). 1886, wheat (four acres). Both the tares and the peas having failed in 1885 through blight, the former could not be fed-off as had been intended, consequently wheat (unmanured) was grown over the whole rotation, Browick wheat, 8 pecks per acre, being drilled on November 7th, 1885. There was a good tilth and the seed went in well. The wheat came through by November 27th. The unfavourable winter and the spring frosts did a great amount of damage; much more indeed than in the case of the permanent wheat-plots, which latter were in a rather less exposed part of the field. In many parts there was a total absence of plant. The wheat was cut on August 30th, 1886, and carted on September 1st, being threshed and weighed on October 20th–22nd. Too much reliance must not, for the reasons stated, be placed on the value of the recorded results; they are found in Table III. The produce was extremely low, as will be noticed.

TABLE III.—PRODUCE OF WHEAT (ROTATION NO. 1), IN 1886, AFTER (*a*) TARES, (*b*) PEAS.

Plots of ½-Acre.	Manures.	Dressed Corn.* Produce per Acre.					Straw, Chaff, &c. per Acre.		
					Bushels.	Weight per Bushel.			
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	No manure (after tares—cotton-cake plot)	10	3	22	20·5	59·85	14	0	0½
2	No manure (after tares—maize-meal plot)	8	0	2	15·5	57·80	11	1	1½
3	No manures (after tares—artificial equivalent of cotton-cake dung) ..	10	3	15½	20·3	60·00	13	0	13
4	No manure (after tares—artificial equivalent of maize-meal dung) ..	7	3	17	15·1	58·80	10	3	8½
5	No manure (after peas—cotton-cake plot	13	0	24	25·15	58·85	16	1	5½
6	No manure (after peas—maize-meal plot)	12	1	15	23·4	59·20	14	3	15
7	No manure (after peas—artificial equivalent of cotton-cake dung) ..	13	1	12	24·8	60·25	15	2	17
8	No manure (after peas—artificial equivalent of maize-meal dung) ..	13	1	10½	24·8	60·13	16	3	15

* The produce being so small, all is given as dressed corn. The tail wheat was considerably less than 1 bushel.

Rotation No. 2.—Four acres. 1885, swedes (two acres), mangolds (two acres); 1886, barley (four acres).

The swedes on the one half of the rotation had been grown in 1885 with 3 cwt. mineral superphosphate per acre, the produce being:—

Plots.	Manure.	Produce of Swedes per Acre in 1885.			
		tons	cwt.	qrs.	lbs.
1	Cotton-cake plot	17	0	2	22
2	Maize-meal plot	17	0	0	16
3	Artificial equivalent of cotton-cake dung ..	14	7	2	4
4	Artificial equivalent of maize-meal dung ..	13	15	2	10

5½ tons of the swedes were removed off each ½-acre plot, *i.e.*, 11 tons per acre, and the rest fed-off on the land by sheep, as follows:—

Plot 1 (half-acre)—3 tons swedes with 200 lbs. decorticated cotton-cake.
„ 2 „ „ „ „ maize-meal.
„ 3 „ —1 ton 14 cwt. with no purchased food.
„ 4 „ —1 ton 8 cwt. „ „ „

On plots 3 and 4, artificial equivalents of the cotton-cake and maize-meal dung respectively were applied to the succeeding barley. A portion only of the crop was consumed in order that the land should not become over-rich, as was believed to have been the case in the previous courses of rotation. The mangolds grown in 1885 without manure on the other four plots of the rotation were got up by November 7th, and carted off. The produce of mangolds, per acre, in 1885 was:—

	Tons	cwt.	qrs.	lbs.
Plot 1.—Cotton-cake plot	11	6	0	12
„ 2.—Maize-meal plot	11	1	0	24
„ 3.—Artificial equivalent of cotton-cake dung	13	1	0	20
„ 4.—Artificial equivalent of maize-meal dung	10	16	2	8

The sheep were eating off the swedes from January 1st to January 28th, 1886. The land was then ploughed and barley drilled over the whole of the rotation. Mineral manures had two days previously been sown on plots 3 and 4.* The barley came up well and was a good crop. Nitrogenous manures † were sown on May 14th upon plots 3 and 4, to complete, with the mineral manures, the artificial equivalents of the cotton-cake and maize-meal dung respectively. The barley was cut and carted in excellent order on August 27th; it was threshed and weighed on October 20th–22nd. The results are given in Table IV:—

* Bone-ash superphosphate, sulphate of potash, and sulphate of magnesia.
† Nitrate of soda.

TABLE IV.—PRODUCE OF BARLEY (ROTATION No. 2), IN 1886, AFTER (*a*) SWEDES FED ON THE LAND, (*b*) MANGOLDS CARTED OFF.

Plots of ¼-Acre.	Manure.	Produce per Acre—Dressed Corn.						Straw, Chaff, &c. per Acre.
		Head-Corn.			Tail-Corn.			
		Weight.	Bushels.	Weight per Bushel.	Weight.	Bushels.	Weight per Bushel.	
		cwt. qrs. lbs.		lbs.	cwt. qrs. lbs.		lbs.	cwt. qrs. lbs.
1	After Swedes fed-off with cotton-cake ..	22 3 1	46·6	54·75	1 1 27	3·5	48·0	25 0 21
2	After Swedes fed-off with maize-meal ..	19 3 3	39·8	55·60	1 0 11	2·6	47·5	19 2 17½
3	After Swedes fed-off, and artificial equivalent of cotton-cake dung	22 3 8	45·9	55·74	2 0 19½	4·86	50·1	26 1 11
4	After Swedes fed-off, and artificial equivalent of maize-meal dung	19 2 26	39·4	56·05	0 3 11½	2·0	47·75	18 0 24½
5	No manure (after mangolds carted off—cotton-cake plot)	17 1 18½	35·8	54·50	1 0 12	2·7	46·50	17 3 26½
6	No manure (after mangolds carted off—maize-meal plot)	17 0 1½	34·5	55·30	2 0 17½	4·8	50·87	19 0 12
7	No manure (after mangolds carted off—artificial equivalent of cotton-cake dung)	19 2 7½	39·7	55·25	0 3 14	2·1	46·50	20 2 26
8	No manure (after mangolds carted off—artificial equivalent of maize-meal dung)	17 1 26½	34·8	56·30	1 0 26½	2·7	51·25	17 3 13½

The produce, as will be seen by a comparison with that on the continuous barley-plots, was a decidedly high one, the latter in only one case (plot 9 B) yielding a higher result than the cotton-cake plot (plot 1). The results are also especially interesting, as giving the first indication of the superior manurial qualities of decorticated cotton-cake over maize-meal. The similarity between the dung in either case and its artificial equivalent is very close, while it is noticeable that the four plots 5, 6, 7, 8, to which no more manure was supplied, are lower in produce than the other four, but yet sufficiently high to lead to the belief that the land, owing to previous high manuring, was still very fertile, in spite of the fact that a crop of mangolds grown without manure and weighing over 11 tons to the acre had been entirely carted off, and no manure at all applied to the subsequent barley crop.

Rotation No. 3.—Four acres. 1886, tares (2 acres); peas (2 acres). This was the first year of the new course of rotation.

TABLE V.—PRODUCE OF TARES AND PEAS IN 1886 (ROTATION NO. 3).

TARES.

Plots. -Acre.		Produce per Acre.							
		Weight.			Number of Bushels.	Weight per Bushel.	Straw, &c.		
		cwt.	qrs.	lbs.		lbs.	cwt.	qrs.	lbs.
1	No manure (after barley—cotton-cake plot)	25	1	23	45·5	62·7	30	3	15
2	No manure (after barley—maize-meal plot)	27	2	19½	48·8	63·5	26	2	16½
3	No manure (after barley with 124 lbs. nitrate of soda, artificial equivalent of cotton-cake dung) ..	28	0	24½	49·2	64·2	27	1	6½
4	No manure (after barley with no manure, artificial equivalent of maize-meal dung)	26	1	9	46·2	63·8	24	1	1½

PEAS.

5	No manure (after barley—cotton-cake plot)	24	0	6	42·3	63·7	21	3	0½
6	No manure (after barley—maize-meal plot)	21	3	20	37·9	64·8	17	1	19½
7	No manure (after barley with 124 lbs. nitrate of soda—artificial equivalent of cotton-cake dung)	26	0	13	45·3	64·5	21	0	27½
8	No manure (after barley with no manure—artificial equivalent of maize-meal dung)	25	3	27	45·8	63·6	20	2	0½

The previous crop was barley; clover had not been sown among the barley. The land was prepared for drilling on March 25th and 26th, and on April 1st four plots were drilled with spring tares, at the rate of 8 pecks per acre, and the remaining four on the same day with white peas (Sangster's No. 1), also 8 pecks per acre. Both came up well and podded capitally. It was intended at first to feed off the tares by sheep, but the crop promising to be so heavy it was felt that there would be, as with the swedes, a risk of returning too much to the soil and producing over-fertility. Accordingly the tares as well as the peas were harvested, the peas being cut on August 3rd and 4th, and carted on August 21st, the tares cut on August 20th, and carted on August 28th. The results are given on Table V. (p. 295).

The produce, it will be observed, fully realized the expectations formed from the growing crop. It was therefore not likely that any great difference of manurial value between the cotton-cake and the maize-meal would as yet show, though in the plots 5, 6, 7, 8, and also in 3 and 4, there is an indication of it.

TABLE VI.—PRODUCE of SWEDES and MANGOLDS in 1886 (ROTATION No. 4).

SWEDES.

Plots. ¼-Acre.	Manure per Acre.	Produce per Acre. Roots.	Produce per Acre. Leaves.
		Tons cwt. qrs. lbs.	
1	3 cwt. superphosphate (after wheat—cotton-cake plot)	4 13 8 20	Very much blighted and therefore not weighed.
2	3 cwt. superphosphate (after wheat—maize-meal plot)	8 15 2 4	
3	3 cwt. superphosphate (after wheat with artificial equivalent of cotton-cake dung)	7 15 2 20	
4	3 cwt. superphosphate (after wheat with artificial equivalent of maize-meal dung)	7 9 1 16	

MANGOLDS.

Plots. ¼-Acre.	Manure per Acre.	Produce per Acre. Roots.	Produce per Acre. Leaves.
			Tons cwt. qrs. lbs.
5	No manure (after wheat—cotton-cake plot)	17 8 1 2	3 6 3 24
6	No manure (after wheat—maize-meal plot)	19 1 1 20	3 10 3 24
7	No manure (after wheat with artificial equivalent of cotton-cake dung)	19 18 3 14	3 4 1 10
8	No manure (after wheat with artificial equivalent of maize-meal dung)	18 13 2 14	3 9 1 4

Rotation No. 4.—Four acres. 1886, swedes (2 acres), mangolds (2 acres). This was also the first year of the new course of rotation, wheat having been the previous crop. The mangolds were drilled on plots 5, 6, 7, 8, on May 3rd, no manures at all being used; while the swedes were drilled with 3 cwt. of mineral superphosphate per acre on plots 1, 2, 3, 4, on May 19th, 3 lbs. of seed being used per acre.

Both crops came up well, but later on the swedes, owing to fly, mildew, and finger-and-toe, were almost entirely spoiled. The mangolds, on the contrary, remained strong, healthy, and sound, and were a very fair crop. They were pulled on October 29th and 30th, and weighed; the swedes were pulled November 8th–12th, and weighed on November 16th. The produce of this rotation is given in Table VI. (p. 296).

It is remarkable that without the application of any manure, a corn crop having also preceded, so large a produce of mangolds as is given in Table VI. should have been realized. A similar effect was noted in the case of Rotation No. 2 last year, strengthening the belief as to the excessive fertility possessed by the land.

Experiments on the Comparative Manurial Values of Decorticated Cotton-cake and Maize-meal, conducted in Lansome Field.

1885, barley; 1886, broad clover. Broad clover had been sown among the barley of 1885, to which latter crop the different manures as given in Table VII. had been applied; no further manuring was employed for the clover. The plots were kept clean and rolled, and the clover was cut the first time on June 25th, 1886, made into hay, and carted and weighed on June 30th. The aftermath was fed off with sheep and the field then ploughed up and sown with wheat. The produce of clover hay is given in Table VII. (p. 298).

With the clover, as with the previous barley crop, the highest result was obtained on the plot to which decorticated cotton-cake meal had been applied direct.

Experiments with soluble and finely-ground Phosphatic Fertilizers in Warren Field (Strong Land).

Red clover was sown among the barley of 1885. The clover was mown the first time on June 26th, 1886, made into hay, and carted and weighed June 30th. It was very full of weeds, and the previously noticed unsuitability of this field for the continuation of experiments being more than ever apparent, it was decided to give it up. Accordingly the weights of clover this year are not recorded.

TABLE VII.—PRODUCE OF CLOVER HAY in LANSOME FIELD in 1886, after BARLEY.

PLOTS. ¼-Acre.	Manures used per Acre for Barley in 1885.	Clover Hay per Acre.			
		Tons	cwt.	qrs.	lbs.
1	No Manure	1	11	1	0
2	With dung made from 9 cwt. decorticated cotton-cake, 120 cwt. white turnips, 20 cwt. wheat-straw chaff, and 48 cwt. wheat-straw as litter; weight about 4 tons	1	11	3	20
3	With decorticated cotton-cake meal, pulped roots and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 2, but applied direct to the land	1	14	1	20
4	No Manure..	1	11	1	20
5	With dung made from 9 cwt. maize-meal, 120 cwt. white turnips, 20 cwt. wheat-straw chaff, and 48 cwt. wheat-straw as litter; weight about 4 tons	1	12	0	8
6	With maize-meal, pulped roots, and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 5, but applied direct to the land	1	9	1	0

EXPERIMENTS ON CLOVERS.

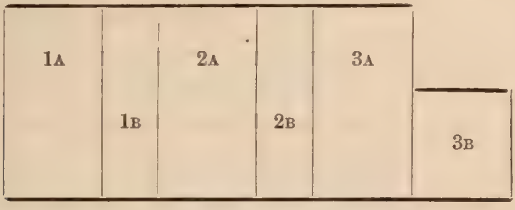
These experiments on the duration of the life of clovers have been continued in both the Stackyard and Warren fields. The white clovers (English and Dutch) from the previous set of experiments * have been allowed to remain; but the other clovers having practically disappeared were re-sown in 1886. Specimen plots of different varieties of grasses are also grown as before in both fields, these plots having been entirely re-sown in 1886 with pure seeds.

EXPERIMENTS WITH PERMANENT PASTURES.

In Great Hill Bottom Field $4\frac{1}{2}$ acres have been set apart for experiments in connection with the laying down of permanent pasture. Three plots of an acre each have been laid down with the same seeds—foxtail, cocksfoot, meadow fescue, tall fescue, timothy, rough-stalked meadow grass, smooth-stalked meadow grass, white clover, alsike, and cow-grass, in different quantities, so that on plot 1 A, 11,577,000 germinating seeds, costing 1*l.* 1*s.* $5\frac{1}{2}$*d.* per acre, have been sown; on plot 2 A, 15,959,000 germinating seeds, costing 1*l.* 10*s.* 7*d.* per acre, have been sown; and on plot 3 A, 20,577,000 germinating seeds,

* Recorded in Journal of Royal Agricultural Society of England, vol. xxii. 1886, p. 252.

costing 1*l.* 19*s.* 3½*d.* per acre, have been sown. On the half acres adjoining each of the acre-plots, the number of seeds of foxtail, cocksfoot, meadow fescue, and tall fescue has been reduced, and replaced by a corresponding number of seeds of perennial rye-grass, with the view of testing the value of rye-grass in permanent pasture. The price per acre has been reduced by the substitution of rye-grass for the more expensive grasses to 16*s.* 4*d.* (1 B), 1*l.* 3*s.* 0½*d.* (2 B), and 1*l.* 10*s.* 2½*d.* (3 B), respectively.



The plots were sown on June 7th, 1886, Nos. 1 A and 1 B being sown down in a crop of oats, but the other plots without a crop. On plots 1 A and 1 B the seeds failed entirely, the field being rather wet and the land where the oat-crop was in not as good tilth. These plots had accordingly to be re-sown on September 8th; on the other plots there was a good plant throughout. In 1887 one half of each plot is to be mown, and the other half fed off.

Crawley Mill Farm is situated near Woburn, Bedfordshire; the soil is a very light reddish loam, about 9 inches deep, with a subsoil of almost pure sand.

RAINFALL at WOBURN during 1886, taken at 8 A.M. daily at CRAWLEY MILL FARM.

	Inches.
January	2·18
February	·32
March	1·36
April	1·63
May	3·51
June	1·44
July	2·47
August	1·36
September	1·25
October	3·40
November	2·52
December	3·61
Inches	25·05

RAINFALL in 1882, 1883, 1884, 1885, 1886.

	1882.	1883.	1884.	1885.	1886.
Inches	28·14	24·20	17·84	25·97	25·05

DURING the HARVEST MONTHS of AUGUST and SEPTEMBER the RAINFALL was—

	1883.	1884.	1885.	1886.
Inches	4·65	2·76	6·65	2·61

XI.—*Annual Report of the Consulting Chemist for* 1886. By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., F.C.S.

I HAVE during the past twelve months analysed 1581 samples sent to me by members of the Society, this being only six short of the number sent to me in the previous year. At the close of this report is given a list of the different kinds of samples analysed, and the number of each.

There has been a large increase in the analyses made of feeding materials, due doubtless in no small degree to the great cheapening of price which these have undergone during the year. In manufactured manures there has been a corresponding decrease. Only half as many samples of nitrate of soda have been analysed, not entirely, I believe, on account of this salt having possibly been less used than before, but also on account of the less frequent adulteration to which it is subjected, although the Quarterly Reports of the Chemical Committee bear evidence to its being not unfrequently sold of an impure nature. Of sulphate of ammonia considerably more samples have been examined this year than last, it having experienced a still further fall beyond that mentioned in my last Annual Report. Its use in consequence, principally as a spring top-dressing, has been much on the increase. So far as my observations have gone—and these are borne out by the experiments conducted at Woburn—in the season of 1886 nitrate of soda, as a top-dressing, has been, on the whole, more productive than sulphate of ammonia, similarly used. As usual, numerous samples of water have been examined; in the majority of cases, I may say, these have been found to be not good drinking-waters, and in many instances quite unfit for use.

In addition to the samples analysed for individual members, the Society has seen its way to extend the use of the Laboratory, when so desired, to local Agricultural Societies, conducting experiments under the sanction, and with the co-operation of the Royal Agricultural Society of England. Manures, &c., used in such experiments have accordingly been examined in the Laboratory, in addition to others connected with the experiments at Woburn.

A prominent feature of the past year has been the cheapening of almost all kinds of feeding-stuffs. In the different kinds of cakes in general use the diminution of price has been very marked. Not only in feeding materials, but also in manures, there has been a great fall, and while the change has been to the advantage of the user, it has affected the trade in anything but a satisfactory way, manures being in many cases, I am fully aware, sold below the cost of production. The competition among seed-crushers and manure-manufacturers has thus very considerably lessened the cost of materials used on the farm, but this has not been obtained without considerable drawbacks as regards the genuineness and the general reliability of the articles sold. As evidence of this it has been my duty, in my capacity of Consulting Chemist, to bring under the notice of the Chemical Committee a larger number of cases than before, in which impure or inferior articles have been purchased as genuine, or at prices far above their intrinsic worth. For details of these cases, reference should be made to the Quarterly Reports of the Committee published in this volume.*

I pass now to the more detailed consideration of the general subjects mentioned above.

Linseed-Cakes.—As in former years, by far the largest number of cakes analysed have been linseed-cakes, and of the 300 examined by me during the twelve months, I am able to state that over half of them were of average good quality. There have been, of course, many of the thin, hard-pressed American cakes, distinguished as a rule by their low percentage of oil and highly nitrogenous composition ; but of the English-made cakes the quality has been as a rule good, and there has been a greater tendency to purchase a rich and pure cake, even if the price has been of necessity somewhat higher. In my last Annual Report I gave a number of cases of high quality cakes, and it is noticeable that of late there have been one or two firms which have gone so far as to guarantee a certain percentage of oil in linseed-cakes. Of "Russian," "Polish," or "St. Petersburg" cakes, as they are called, there has been a smaller

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* Vide p. 319, *et seq.*

supply, but, wherever heard of, these have been eagerly purchased, though their purity has not, as a rule, been so well maintained as previously.

Linseed-cakes low in oil have been mentioned, and as examples of these I may quote the following:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Moisture	7·13	11·98	8·32	11·95	7·60	12·01	14·65
Oil	5·67	6·16	5·33	6·27	5·67	2·97	6·43
*Albuminous compounds	32·12	34·33	34·85	32·81	35·35	29·44	28·50
Mucilage, &c.	39·70	32·69	37·25	34·61	37·08	40·60	34·44
Woody fibre	9·40	9·60	8·30	8·77	8·70	9·53	10·20
Mineral matter	5·98	5·24	5·95	5·59	5·60	5·45	5·78
	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	5·14	5·49	5·57	5·25	5·65	4·70	4·56

Most of these, though not all, have been American cakes, and their cheapness has no doubt attracted buyers; but I cannot believe that cakes of such a hard-pressed nature, and having so little oil in them, are, even at low prices, to be compared with good cakes containing 10 or 11 per cent. of oil, or more, and which are so much softer and in better mechanical condition for purposes of feeding.

Of impurities in linseed-cakes the one most marked by its frequent recurrence is sand. I drew attention to this last year, but there is now still greater reason for fault-finding. The following analyses give evidence of the quantity of fine sand which is not unfrequently met with in linseed-cakes. Several of these cakes were sold under the name "pure," and were branded as such:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.
Moisture	9·08	10·01	11·48	10·30	13·22	12·88	12·66	13·83
Oil..	11·70	9·83	10·03	12·53	14·23	9·63	8·93	8·31
*Albuminous compounds	23·37	23·19	20·08	24·75	23·56	24·51	25·02	23·69
Mucilage, &c.	28·79	31·36	37·45	31·00	28·30	32·14	33·35	30·13
Woody fibre	14·43	9·60	9·13	9·27	7·17	8·31	8·63	7·91
†Mineral matter	12·63	16·01	11·83	12·15	13·52	12·53	11·41	16·13
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	3·74	3·71	3·53	3·96	3·77	3·92	4·00	3·79
† Containing sand ..	7·18	10·10	5·94	6·80	7·43	6·59	5·43	10·04

It has been repeatedly urged on members when purchasing linseed-cake—and it must be done so again—that they should stipulate that it be described as "*pure*," and insist upon this word occurring in any contract, and on the invoice. In many cases that have come under notice it has been impossible to obtain any reparation, owing entirely to neglect of this precaution.

By contradistinction to these poor-quality cakes, it happens from time to time that the purchaser secures at a low price a cake of extremely good quality. As an instance I quote the following:—

Moisture	12·23
Oil	13·01
*Albuminous compounds	29·56
Mucilage, &c.	32·69
Woody fibre	7·47
Mineral matter	5·04
	100·00
* Containing nitrogen	4·73

This cake I reported upon as being a pure and very fine cake. It had been purchased in Liverpool, the price of it in December last being 6*l.* 18*s.* 9*d.* per ton. It was quite free from sand, and was known as "Chilian" cake.

On several occasions I have detected the presence of rape, and also mustard seed, while Niger seed, too, has been a frequent source of adulteration.

Decorticated Cotton-cakes.—These stand next to linseed-cakes in importance, but a still further change and deterioration in their quality have been experienced since last year.

In consequence of improved machinery, by means of which a greater proportion of oil can be extracted, it has become indeed a matter of great difficulty to secure a cake, the condition of which is such that it can be safely recommended for use without taking special precautions to prevent its hardness (and consequent indigestible tendencies) being felt to the detriment of stock.

The record of this year shows that the percentage of oil has sunk lower and lower, and to meet with a cake of good composition and condition is now of rare occurrence. From time to time small lots of really good cake, containing 16 or 17 per cent. of oil, and resembling the old style of cake, are heard of, but these are snapped up instantly. If more were obtainable, it would, I feel sure, find buyers in abundance, even at an increased price.

Last year I spoke of the average percentage of oil as being not much above 12 per cent., but now 12 per cent. is reckoned as good quality, while the occurrence of cakes with only 9 per cent. of oil is by no means unfrequent. I fear that there is little prospect of improvement in this respect, for I am informed that the entire export of decorticated cotton-cake from America to this country is in the hands of a Syndicate, and that, if anything, there will be still more oil extracted in future than has been the case up to now. To the English farmer this is a matter of great concern, and much to be regretted. Experiments made with this cake, both at Woburn and elsewhere, have established its great value as a food for fattening and milk-producing, and also its high manurial properties; but I cannot believe that the same can continue to be said of it when its condition is like that of the majority of cakes I have this year examined. A very striking fall in the price of this cake has been experienced, which is not to be wondered at; but I venture to express the opinion that those who have the control of the supply of decorticated cotton-cake to this country would do well to express less of the oil, and pay more attention to the production of a cake which can be safely used for feeding purposes. If this were done, the farmer would be willing to pay a price considerably in excess of the present rate. The use of cake ground into meal is frequently recommended, but this will not, I think, become popular, as a considerable amount of suspicion attaches to a meal, which does not enter in the case of a cake. As examples of decorticated cotton-cakes which have been of low quality I append the following:—

	No. 1.	No. 2.	No. 3.
Moisture	9·27	8·11	12·50
Oil	8·17	8·80	7·43
*Albuminous compounds	45·93	48·43	46·62
Digestible fibre, &c.	24·82	25·24	23·73
Woody fibre	4·73	3·40	3·47
Mineral matter	7·08	6·02	6·25
	100·00	100·00	100·00
* Containing nitrogen ..	7·35	7·75	7·46

Undecorticated Cotton-cakes have been generally good in quality, though now and again they are found to be inferior, owing to their containing a large amount of husk, and also to having cotton-wool left in quantity still attached to the seed.

Cottonseed-meal.—A sample of whole-seed cotton-meal, from which the oil had not been expressed, was submitted to me. The analysis of it was:—

Moisture	10·36
Oil	21·76
*Albuminous compounds	18·37
Digestible fibre, &c.	26·68
Woody fibre	18·50
Mineral matter	4·33
	100·00
* Containing nitrogen	2·94

The analysis shows the meal to have been very rich in oil, but at the same time there was so much cotton left with the seed (which in consequence of the quantity of oil tended to clog considerably) that I should have been rather afraid of giving such a meal to stock. The price of this was 7*l.* 8*s.* 4*d.* per ton, delivered.

Rice and Feeding-meals.—I have had occasion previously to note the variations that occur in the quality of rice-meal. A sample of rice-meal was forwarded to me which I was informed was warranted "pure," but with respect to which it was stated that it was very inferior to any meal purchased before, and that beasts would not eat it. My analysis of the meal was:—

	Rice-Meal.	Feeding-Meal.
Moisture	7·60	9·65
Oil	7·30	5·40
*Albuminous compounds	8·19	9·14
Starch, digestible fibre, &c...	53·43	35·88
Woody fibre	13·80	33·33
Mineral matter	9·68	6·60
	100·00	100·00
* Containing nitrogen	1·31	1·46

The rice-meal—though the whole of it came from rice, and could not therefore be said to be adulterated—was nevertheless of poor quality. Besides being low both in oil and in nitrogenous compounds, it contained a very high amount of indigestible fibre, and had evidently been made from the coarser part of the grain; 6 to 7 per cent. of fibre is about the amount

contained in a good rice-meal, while this sample had nearly 14 per cent., and it was probably in consequence of this that the beasts did not take kindly to it.

In a feeding-meal of which the analysis is given above, no less than $33\frac{1}{3}$ per cent. consisted of indigestible woody fibre, a most unsuitable amount.

Wheat - Germ.—Under the name of *wheat - germ* I have examined a nice and rich material which would be suitable, I should say, for fattening and especially for milk-producing purposes. Its mechanical condition was good, and it had a pleasant sweetish taste. The following was the analysis:—

Moisture	9·91
Oil	10·53
*Albuminous compounds	27·75
Starch, sugar, digestible fibre, &c. ..	45·70
Woody fibre	1·53
Mineral matter	4·58
	100·00
* Containing nitrogen	4·60

This, it will be noticed, is as rich in oil and in nitrogen as good linseed-cake.

Lupins.—The following is an analysis of lupin-seeds sent to me:—

Moisture	11·75
Oil	10·37
*Albuminous compounds	33·24
Starch, digestible fibre, &c.	33·06
Woody fibre	9·03
Mineral matter	2·55
	100·00
* Containing nitrogen	5·30

The seeds contain a bitter principle, which makes sheep dislike them at first. If sheep can be once got to eat them, they make a good food, and the analysis fully bears this out, the lupins being, as regards oil and nitrogen, somewhat higher in composition than a good linseed-cake. Their use for horses, cattle, or pigs is not recommended, and it would appear that on the whole the best use that lupins can be put to is to cut them green as fodder.

Spogel Seeds.—A sample of these was also submitted to me. This is the seed of a species of *plantago*, and was believed to

be equal to linseed, but, as the figures of the analysis show, it is in no way to be compared with the latter.

Moisture	11·01
Oil	4·53
*Albuminous compounds	13·87
Mucilage, starch, digestible fibre, &c. ..	48·33
Woody fibre	18·31
Mineral matter	3·95
	100·00

* Containing nitrogen .. .. .. 2·22

Manures.—Reference has been already made to nitrate of soda and sulphate of ammonia; in both cases adulteration has been less frequent than before.

Raw unboiled bones, whether sent as ½-inch bones, ¼-inch, or as bone-meal, have been of remarkably good quality and purity; but the same cannot be said of boiled bones, many cases of adulteration of which I have had to report. The principal admixtures in the case of boiled bones are common salt, sulphate of lime (gypsum), and carbonate of lime (chalk). In several instances an endeavour has been made to impress upon me that the admixture of salt is really an advantage. But I fail to see how that can be of advantage to the farmer; and even were it so, he would find it better to purchase the bones separately and the salt separately, and mix them himself, if he wished to do so, rather than pay for the admixture of salt at the same rate as for the more expensive bone.

Refuse-Manures.—Continued agricultural depression has often attracted the attention of farmers to manures, almost the only recommendation of which has been their low price. In the Quarterly Reports I have over and over again referred to several of these manures, and the false economy involved in their purchase. It is, nevertheless, striking to see how, despite the publicity given to these warnings, such manures continue to find a sale, and how inquiries are still made of me which the perusal of the pages to which I have referred would satisfactorily answer.

Fish-Manures.—Mr. John Hughes, in the 'Agricultural Gazette,' of May 3rd, 1886, called attention to the very varying amounts of oil present in different samples of fish-guano, rightly remarking on the drawback that this was to their employment as manures. Following upon Mr. Hughes's observations, I have made several determinations of the oil contained in samples of fish-manure sent to me lately, and quote the following:—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Moisture	7·30	12·50	38·14	10·29	22·05	5·61	12·55	15·57
Oil	3·06	4·87	7·36	7·76	8·63	9·20	17·47	19·37
*Organic matter ..	39·45	52·07	16·02	53·28	46·80	55·44	51·84	54·36
Phosphate of lime	18·12	10·59	8·61	17·51	13·23	12·52	11·66	8·71
Alkaline salts, &c.	31·32	16·03	26·78	7·87	6·50	16·88	4·89	1·10
Sand	·75	3·94	3·09	3·29	2·79	·35	1·59	·89
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	5·74	8·44	2·75	7·98	7·62	8·01	8·09	8·37
Equal to ammonia	6·97	10·24	3·34	9·69	9·25	9·73	9·83	10·16

It will be seen that the oil varies from 3 per cent. to over 19 per cent., though the existence of a relation noted by Mr. Hughes, between a high percentage of oil and the low quality of a guano as regards nitrogen and phosphates is not borne out. The presence of a large quantity of oil is no doubt bad, as retarding the decomposition of the guano, and it would be advisable, as Mr. Hughes says, to restrict the occurrence of it in quantity.

Peruvian Guano.—For a considerable time Peruvian guano has been somewhat under a cloud; much uncertainty has been felt with regard to its quality and condition, and the prices charged for it were very high when compared with those of other manures; its use accordingly decreased. Towards the close of last year, however, in consequence of a new contract having been entered into with the Chilian Government, a great reduction was made in the price of guano, and together with this came an improvement in its quality and mechanical condition. The purchaser can have now, at prices varying according to quality, genuine Peruvian guanos, which offer a wide range for selection; these can be obtained in uniform condition and free from the stones that have previously proved so great a trouble. The manurial constituents of the guanos now being imported are obtainable at prices which are very similar in their cost to other manures in general use.

Basic Cinder.—To this material, lately introduced into England, but which has been used for some time past on the Continent, a great deal of interest attaches. It is the slag obtained in the "Basic" or "Thomas-Gilchrist" process (introduced in 1879) for manufacturing steel from pig-iron containing phosphorus. This slag is highly calcareous and phosphatic; for a long time it was treated as useless, but has of late been used on the Continent as a manure, it is said, with most favour-

able results. In Germany alone some 180,000 tons per annum of the slag are produced. The price of this material is at present about 25*s.* or 30*s.* a ton. It contains from 16 to 19 per cent. of phosphoric acid, besides lime in large quantity, and also compounds of iron, which latter it is maintained do not have (as might be supposed) a prejudicial influence on crops.

The following is an analysis of a sample recently analysed by me:—

Basic Cinder.

Moisture	·20
Water of combination, &c.	3·24
*Phosphoric acid	16·36
Lime	45·08
Ferric oxide	12·26
Ferrous oxide	6·11
Alumina	6·21
Magnesia	2·99
Sulphuric acid	·34
Insoluble siliceous matter	7·21
	100·00

* Equal to tribasic phosphate of lime 35·71

The secret of its efficacy, it would appear, lies in the fact of its being most finely ground; and it is maintained that, if this is done, the value of the slag is very great, and that, roughly speaking, 4 cwt. of it applied per acre would be about equal in effect to 3 cwt. per acre of mineral superphosphate.

At my request several gentlemen undertook last year to experiment with the slag, or "basic cinder," as it is called, but the reports that have reached me have not been satisfactory. I am assured, however, that this is due solely to the material not having been ground finely enough, and that, since then, new machinery has been set up to accomplish this purpose. The material contains elements which, without doubt, ought to render it useful as a manure, and I should consider it well worth a trial, though for the present I prefer to withhold my judgment upon it, intending, as I do, to make experiments with it myself this year.

Meantime the purchaser should be careful to stipulate for being supplied with the "cinder" in a state of excessively fine division, and of guaranteed quality.

I have contributed the following Papers to the 'Journal' of the Society during the year:—

1. Report on the Field and Feeding Experiments at Woburn during the year 1885.

2. Report of Experiments on Ensilage at Woburn during 1884–5 and 1885–6.
3. Sheep Feeding Experiments at Woburn during 1885–6.

J. AUGUSTUS VOELCKER.

List of Analyses made for Members of the Royal Agricultural Society of England from 1st *December*, 1885, *to* 30*th November*, 1886.

Feeding-cakes	572
Compound cakes	11
Feeding-meals	54
Corn, hay, &c.	4
Superphosphates, dissolved bones, and compound manures	381
Guanos	61
Coprolites	3
Bones, bone-meal, &c.	104
Refuse-manures	28
Manure-cakes	14
Sewage-manures	18
Fish-manures	39
Dried blood	3
Wool-dust and shoddy	24
Nitrate of soda	35
Kainit and potash salts	20
Sulphate of ammonia	59
Soot	5
Lime, limestone, gypsum, marls, minerals, &c. ..	14
Soils	27
Waters	77
Milk, cheese, butter, bread	5
Examinations for poison	7
Ensilage	7
Miscellaneous	9
Total	1581

XII.—*Report of the Consulting Entomologist for the Year* 1886. By Miss ELEANOR A. ORMEROD, F.R.Met. Soc., Dunster Lodge, Spring Grove, Isleworth.

DURING the past year the amount of inquiry sent to me by members of the Royal Agricultural Society, or by reason of my holding the office of Entomologist to the Society, has much increased. The amount of business letters relative to entomological matters which it has been necessary for me to write has been, approximately, 1100. Of these, many have been with regard to identification of insect attack, together with information needed for immediate farm use; others on points regarding

instruction and illustration, and subjects bearing more generally on insects; and a portion has consisted of necessary interchange of communications with some of the leading entomologists of the British colonies, and the United States of America.

The most important crop-attacks of the past season have been those to cereals, including the Hessian fly, injuries to barley and wheat, corn-saw fly-maggot in wheat-stems, and a small fly-maggot in bulbs of young wheat, and the disease known as tulip-root in oat-plants, from almost their first growth to a stunted maturity.

Since reporting on Hessian fly in November, I have received information of "flax-seeds" being found at another farm, in the siftings beneath the threshing-machine. I have also received a communication from the Agricultural Experimental Station of the University of California regarding the appearance of Hessian fly to a serious extent in that country during 1885. I have thought it desirable to communicate on the subject of the Hessian fly being present in this country, and regarding measures available as preventive treatment, with the Consulting Entomologist of the Dominion of Canada, and likewise with Professor Saunders, now Director of the Experimental Farm Stations, both of whom are well qualified to offer excellent advice. I have also written on the subject to Professor Riley, State Entomologist of the Department of Agriculture, Washington, U.S.A., and others of the State Entomologists with whom I have the benefit of being in occasional correspondence, and who, should they think fit to do so, are in a position to give much valuable information regarding the *Cecidomyia destructor*.

I am giving every attention in my power to the subject, and shall duly report as requisite.

Corn-saw fly attack (scientifically that of *Cephus pygmæus*) has occurred to a slight extent, and is sometimes taken for that of Hessian fly, as in both cases the injured straw falls. The attacks, however, may very readily be distinguished, for in the injury from saw-fly, the straw does *not* bend at a sharp angle, but falls, in consequence of the stem being cut through at ground-level by the maggot, which lives and feeds within the stem, and turns to a chrysalis within the lowest part. Sometimes great injury is thus done, but recurrence of the attack may be prevented by collecting and burning the stubble at any time after harvest, before the saw-fly comes out of the chrysalis in the cut stumps, which occurs towards the end of spring in the following year. Wheat bulb fly-maggot has again been troublesome; we need more information regarding it.

The disease known as "tulip root" (Fig. 1) in oat plants has been serious and widespread. It has occurred to a very injurious

extent at various places in Mid-Lothian and Linlithgowshire, and in the shires of Lanark, Renfrew, and Aberdeen; more southerly, it has occurred in Yorkshire, and has also injured young winter oats at a locality in Berkshire. The diseased plants may usually be known by the swollen tulip-like base of the stem, and the numerous pale, stunted, and crumpled up shoots surrounding it; but in diseased plants, which have attained maturity, I have not found the pale side shoots, and in very young infested plants I only found a swollen gall growth, which, conjecturally, presently increases into the diseased swelling known as "tulip-root."

Fig. 1.—*Oat-Plant with "Tulip-root" disease.*

I found the *Anguillulidæ*, or nematode worms, commonly known as "eel-worms," which are considered (and I believe) to cause this disease in great numbers in the brown, crumbly, and decaying matter inside the swollen base of the oat-plants, also sometimes within the sheathing-leaves, and likewise within the contorted side shoots. Eggs also were sometimes present. From the excessive minuteness of these thread-worms it is not yet clearly ascertained, as far as I am aware, which species causes the oat disease in this country. It has been considered that the *Heterodera* (? *Tylenchus*) *radicicola* may be the special kind. I find that the injuries described as following on presence of the *Tylenchus dipsaci*, Kuhn., in corn, correspond with our oat attack, but whether more kinds than one are present, or whether one kind may not pass under several names, is not as yet clearly ascertained.

In regard to prevention, it has been recorded that the genus *Tylenchi* have enormously prolonged living powers, and in the case of the *Tylenchus tritici*, which produces wheat-ear cockle, the wormlets have been found by the late Dr. Cobbold to have a power of existing for four or even five years. Much longer periods are assigned by other observers. This points directly to the importance, when once a crop is infested, of not again putting that crop in till there is reasonable cause to suppose the land is clear.

In consequence of it being considered that the attack followed beans, I examined for "eel-worms" in various parts of bean-stumps and roots, but found no trace of these. In several instances the attack has occurred after turnips, and I have received a plan of infested fields, in which the diseased portion was limited to a long strip, in one instance across, and in

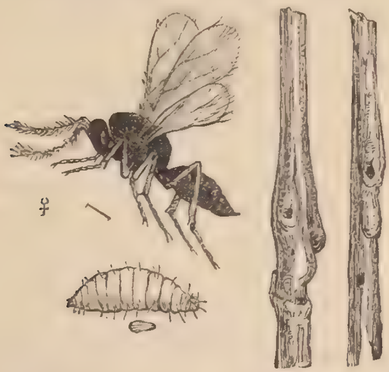
another at the edge of the field, with the area as clearly defined as if it had been divided by a straight plough-line, thus pointing strongly to some local cause.

The only application, which has been reported personally to me as of service, is sulphate of potash. Nitrate of soda was found of no service. At present, change of crop, and great suspicion of manure made from diseased oat-plants, are the main points suggested.

Ear-cockle occurred in two localities. On stripping one of many ears sent me, I found fifty-eight or more cockle galls, and not one sound grain. Steeping in sulphate of copper is advised for infested seed; but even throwing in water for a short time would apparently answer every purpose, as in the experiment I have tried, the cockle galls floated without any exceptions, and all the wheat which I tried, excepting some very abortive grains, sank. Skimming or floating off the cockles from the full water tub would to all appearance clear the infested wheat completely.

I have been specially desired by various seed-merchants and farmers to draw attention to the great danger incurred by the

Fig. 2.—*Isosoma hordei* (Harris).



Joint-worm fly and maggot magnified, with nat. length. Galls on wheat stems caused by maggot.

increased spread over the country of screenings of imported corn, so foul with various kinds of insects that in specimens sent to me the term "alive with them" was no over-statement. The screenings, or injured foul corn, are sold at very low rates for poultry food or other purposes. As in what I have examined, I have found wheat webbed together by caterpillars, and also broken pieces of straw, it is evident that the screenings are perfectly suited to the conveyance of serious corn pests such as

the Angoumois moth, and the "joint-worm," or maggot of the *Isosoma hordei* (Fig. 2), a most destructive pest in North America to many kinds of corn. I have also found presence of ergot.

The mustard-beetle circulars have not been largely responded to, but the replies which have been forwarded by about twenty-five or thirty mustard-growers, resident at various localities in the mustard-growing districts, from Foulness to the Humber, give useful information, both as to treatment suitable for lessening effect of attack, and regarding the various distinct kinds of beetles which cause it. I have condensed the main points of the communications into a paper, now presented for acceptance, if approved, for the 'Journal' of the Society,* and therefore do not enter at present into the details.

A vast incursion of earwigs made serious havoc on common field-crops—as turnips, kale, &c., and even in one instance on tobacco—at various localities in several of the southern or midland counties, and then disappeared. From previous records of similar mischief, there does not appear to be any reason to fear its continuance next year.

Enquiries have, as usual, been sent in regarding the customary crop-attacks; but it is satisfactory to find that much less information is now sought regarding turnip-fly, Daddy Longleg-grubs, and wireworms, concerning which detailed reports have been given.

The occurrence of destructive insects of various kinds, especially of *Psoci* and different kinds of weevils in stored seed, more particularly in mangold-seed and beans, has been reported, and I have drawn attention to the use made in Canada and the United States of the vapour of bisulphide of carbon for destroying the insects without injuring the seed. The bisulphide may either be poured on anything preferred, laid at the top of a large vat full of seed (beans for example), and the vat then temporarily closed; or it may be applied somewhat in the way as when used for prevention of Phylloxera, by pouring some of the bisulphide into a hollow tube with perforations in the side, and thrusting the tube into the heap of seed, thus poisoning the insects which it contains.

Rather more attention is being given to bot-fly attacks of various kinds. The observations sent in have strongly confirmed those previously given—that where ox-warble maggots are destroyed in the spring by the very simple means already described, the summer attack is satisfactorily prevented, so far as the area of the spring destruction has extended. It is in contemplation in one district to form an association, offering a

* The article in question forms one of the papers in the present number (pp. 273 to 284).

bounty of so much per score or hundred for maggots extracted, so as to insure co-operation over a fairly large area of country.

Warble in horses has proved to be much more widely spread than was supposed. The fly has been reared from the warble maggot, and reported to me as being very like that of the ox-warble maggot—the *Hypoderma bovis.* I hope to report on this more fully on receipt of the specimens.

I wish to add one more observation, as, although not precisely agricultural, the losses involved have been very severe. I have been desired both by English exporters and South African importers to inquire into the cause of insect injuries to leather boots, whereby a large amount of these goods were seriously damaged or totally ruined. I found the boots tunnelled between the leather and lining, or pasted parts generally, by the maggots of a small beetle, which after much consultation as to it being certainly English, proved to be the common *Anobium paniceum*, a beetle which is especially attracted by pasted leather. I therefore suggested that the subject of the paste used should be considered, and I am now informed that where a preparation of dextrine (which does not contain anything suitable for maggot-food), together with some flour paste containing an admixture of chloride of zinc, has been substituted for common paste, no further complaints have been received regarding insect damage.

XIII.—*Report of the Consulting Botanist for* 1886. By W. Carruthers, F.R.S.

During the past year I have dealt with 344 applications from members of the Society, the great majority having reference to grass seeds for laying down permanent pasture. I have to report, as the general result of these investigations, that the quality of the seeds has been maintained.

The samples of meadow fescue (*Festuca pratensis*, Huds.) were remarkably free from rye-grass, though 8 per cent. contained from a quarter to nearly a half of this much cheaper and less valuable grass. Such quantities are due to deliberate adulteration. The germination of the seeds of this grass was high—88 per cent. being the average of the whole, and, but for two samples that had a low germination, the average would have risen to 95 per cent.

The samples of tall fescue (*Festuca elatior*, Linn.) were on the whole of superior quality. They were generally true, though one sample contained 50 per cent. of rye-grass, and some others

were largely made up of meadow fescue. The average germination amounted to 76 per cent., but a considerable number did not reach 60 per cent. The most serious impurity present in this grass was ergot, which occurred in 12 per cent. of the samples. The favourite natural locality for tall fescue is the banks of streams or ditches, and there ergot is likely to be more abundant than anywhere else in a field.

The smaller and less important fescues were this year true to their several kinds. The germination of sheep's fescue (*Festuca ovina*, Linn.) was low, being only 53 per cent., while the samples of hard fescue (*Festuca duriuscula*, Linn.) were good, averaging 74 per cent. These smaller wiry fescues are desirable elements in a good pasture, only in upland or otherwise exceptional localities.

The samples of cock's-foot (*Dactylis glomerata*, Linn.) were generally free from impurities, and where impurities occurred they were obviously due to careless harvesting or imperfect cleaning, and not to deliberate adulteration. Yorkshire fog (*Holcus lanatus*, Linn.) was the chief impurity, and it was occasionally accompanied with rye-grass and fescues. The germination maintained a high average, amounting to 79 per cent.; some samples fell below 50 per cent., but a considerable proportion were over 90 per cent.

A large proportion of the samples of meadow foxtail (*Alopecurus pratensis*, Linn.) contained the seeds of tufted hair-grass (*Aira cæspitosa*, Linn.), and often in considerable quantity, amounting to 14, 18, and 22 per cent. The germination of this grass throughout the past year was, on the whole, poor, yet only 9 per cent. of the samples fell below 50 per cent. of germination.

Yellow oat grass (*Avena flavescens*, Linn.) had a high germination, but all the samples examined by me had a considerable proportion of other seeds, chiefly meadow grass and small seeds of dogstail.

The samples of Timothy (*Phleum pratense*, Linn.) were, as a rule, clean, though this grass is often the vehicle of conveying weeds into a pasture. Several samples contained from 8 to 12 per cent. of the seeds of sorrel, chickweed, poppy, scorpion grass, and self-heal. The average germination reached 89 per cent., but the great majority were considerably over 90 per cent.

The meadow grasses were very unequal, both in quality and germination. Rough-stalked meadow grass (*Poa trivialis*, Linn.) was generally free from the seeds of other grasses, but one sample was made up of nearly 50 per cent. of small seeds of dogstail. The germination averaged 65 per cent., but a few samples did not have a quarter of the seeds germinating, while

a considerable number grew over 90 per cent. The smooth-stalked meadow grass (*Poa pratensis*, Linn.) was free from admixture of other seeds; the germination, however, averaged less than 50 per cent. The wood meadow grass (*Poa nemoralis*, Linn.) contained in the majority of samples the seeds of tufted hair-grass (*Aira cæspitosa*, Linn.), and in some small seeds of cock's-foot.

The small annual vernal grass (*Anthoxanthum Puelii*, Lecoq. and Lam.) was absent from all the samples of sweet vernal grass that were examined by me. The average germination of this grass was 54 per cent.

The samples of dog's-tail (*Cynosurus cristatus*, Linn.) were free from admixture with other seeds, and the germination had average of 83 per cent.

Fiorin (*Agrostis alba*, var. *stolonifera*, Linn.) contained ergot in each specimen that came into my hands. The germination an of this grass averaged over 90 per cent.

The clovers were generally pure; the samples of Alsyke were quite free from dodder, but 16 per cent. of the samples of red clover contained the seeds of this destructive parasite. Sorrel is a very common weed in clover-seed, and a large number of the samples of white clover this year contained considerable quantities of it. The germination of the clover-seeds was satisfactory. Red clover (*Trifolium pratense*, Linn.) had an average of 95 per cent. of germinating seeds; white or Dutch clover (*T. repens*, Linn.) average 90 per cent.; Alsyke (*T. hybridum*, Linn.) germinated 95 per cent.; and trefoil, or yellow clover (*Medicago lupulina*, Linn.), had an average of 94 per cent. germinating seed.

The grass mixtures that I have examined during the year have been of a much better quality than in previous years; but I have still abundant evidence that those mixtures, as a rule, supply a very poor material for the production of good pastures, and are the chief means of introducing worthless grasses and weeds into meadows. Thus, a sample supplied to one of the members of the Society as an "autumn mixture of grass and clovers," consisted of 50 per cent. Italian rye-grass, 25 per cent. common rye-grass, 2 per cent. each of dog's-tail, Yorkshire fog, and brome grass, and 19 per cent. of clovers; another, as "grasses and clovers for one year's hay," consisted of 12 per cent., Timothy, 25 per cent. rye-grass, 44 per cent. clovers, and 13 per cent. of turnip- or some allied seed.

In the seeds of cereals, I have to note the presence of a considerable quantity of *Bromus secalinus*, Linn., a troublesome weed, which, when present in any quantity in grain, gives a bitter taste to the flour. A sample of wheat which looked well

was found under the test of germination to yield only 60 per cent. of germinating seeds; and from the dissection of the seeds which did not germinate, there can be no doubt that the failure was due to the seed being three or four years old.

I have found great objection to take efficient steps to destroy parasites which have attacked crops. It is important when it is possible to prevent the spreading of the parasite further in the existing crop, but it is still more important to prevent its reappearance in subsequent years. Thus, in clover attacked by dodder, the ploughing up or digging over the diseased part, without the destruction of the seeds by fire, is only placing the seeds of the dodder in the best position for preservation. When the ground is again turned over the buried seed, it will germinate and attack any suitable, or even unsuitable, plant within its reach. I have recorded in the Society's 'Journal' that a crop of turnips was under these circumstances attacked by dodder.

For the same reasons, I have recommended that a crop of onions attacked by *Peronospora schiedeniana*, Ung, a fungus allied to that which causes the potato disease, should be destroyed by fire, and the cultivation of onions in the field should be stopped for some years. The spores in those years not meeting with the proper host plant for their growth would perish.

Another case of injury done to stock by eating saffron (*Colchicum autumnale*, Linn.) has been brought under my notice. This plant has its year's life separated into two distinct epochs—the reproductive and the vegetative. In the autumn the flower appears, developing at the expense of the starch food that has been stored up in the bulb. At the base of the long corolla tube, the small seed-vessel is formed, which remains buried in the ground through the winter. In the spring the large dark green leaves appear, and with them the oblong fruit borne on a long slender peduncle which springs from the deeply-buried bulb. The leaves prepare the material for their own growth, and store up in the bulb a supply of food, which is employed in producing the flowers in the autumn, and the fruit in the following spring. The leaves wither and die before the flowers appear. The expense of digging out the deeply-buried bulbs of the meadow saffron is very great, and not always efficient, as bulbs may be overlooked. Diligent hand-pulling will in time eradicate the weed; but it will do no good to pull the flowers in autumn. The plant should be pulled in spring. The leaves and the unripe fruit being then removed, the plant is left in its most impoverished condition, and this pulling of the leaves being repeated once or twice will destroy the saffron.

XIV.—*Quarterly Reports of the Chemical Committee.*

March, 1886.

1. Mr. Ernest Bomford, of Spring Hill, Fladbury, Pershore, sent on June 5th, 1885, a sample of hop-guano, two tons of which he had purchased from the manufacturers at 4*l.* 10*s.* per ton. After analysis of it Dr. Voelcker reported:—

Moisture	23·95
*Organic matter	19·86
Phosphate of lime	2·17
Oxide of iron and alumina	6·44
Sulphate and carbonate of lime, alkalies, &c.	28·07
Insoluble siliceous matter	19·51
	100·00
* Containing nitrogen	·61
Equal to ammonia	·74

"This is worth nearer 9*s.* than 90*s.* a ton. J. Augustus Voelcker."

Mr. Bomford complaining of the result, the manufacturers sent the following copies of analyses:—

Sibson.

Moisture	11·64
*Organic matter	40·37
Phosphate of lime	4·62
Sulphate of lime	4·31
Nitrate of soda and alkaline salts	27·36
Insoluble matter	11·70
	100·00
* Containing nitrogen	8·10
Equal to ammonia	9·91

Dyer.

Moisture	19·12
Organic matter	30·18
Phosphate of lime	9·38
Nitrates, carbonate of lime, &c., &c.	35·17
Siliceous matter	6·15
	100·00
Organic and ammoniacal nitrogen	2·17
Nitrogen in the form of nitrates	4·29
Total nitrogen	6·46
Equal to ammonia	7·84

and wrote:—

"E. Bomford, Esq. June 20th, 1885.

"Dear Sir,—We are very disappointed with result of the analysis of hop-manure sent this morning; it is the more disappointing because we know the value was put into the manure.

"By the same post we received the report of a sample sent by one of our customers to Professor Dyer, showing 7·84 ammonia, and on Tuesday we got one from Professor Sibson, showing 9·91. We enclose both for your inspection. If you will not accept these assurances that we have really sent you value, we will send down to take a fresh sample from yours.

"We will do anything in our power you may wish to prove that we have really sent you good value.—We are, dear Sir, yours faithfully,

"——"

"P.S.—The enclosed we must ask you to return by first post, and hand stamped envelope. We should be quite willing for payment to stand over until the manure has had time to prove itself."

Mr. Bomford next wrote to say that a sample had been sent to Mr. Smetham, of Liverpool, which showed, ammonia 3·15 per cent., phosphate of lime 3·56 per cent., and nitrate of soda 21·20 per cent., and that it had been decided to take the mean of this and Dr. Voelcker's results. Dr. Voelcker, however, re-tested the sample, and finding no trace of nitrate of soda present, inquired how the samples had been taken, and hearing in reply that the vendors' manager had been allowed both to draw and to send off the reference sample to Mr. Smetham, it not even being sealed by the purchaser, Dr. Voelcker wrote and obtained from Mr. Smetham a portion of this sample, and found that it contained some considerable amount of nitrate of soda, and was very different from the sample first sent to himself. After this Mr. Bomford received the following letter:—

"E. Bomford, Esq. August 13th, 1885.

"Dear Sir,—Replying to yours of yesterday, under such suspicious circumstances we cannot blame you.

"We can only add that we sold you the goods in all good faith, and if there was any tampering with the sample, it was without our knowledge or consent.—We are, dear Sir, yours truly, "——"

And later Mr. Bomford wrote:—

"I still think —— did not know of the sample being tampered with, and that it must have been done by their manager who drew the sample, and who is paid by them on the basis of analysis, but of course I have no proof of this."

Ultimately the vendors agreed to accept 15*s.* per ton delivered for the manure, on the basis of Dr. Voelcker's original analysis.

The Committee have seriously considered whether they ought not to publish the names in this case, which appears to be a very bad one, and have only reluctantly abstained from doing so on account of the want of precaution on the part of the purchaser to secure the identity of the several samples analysed, and of the way in which he appears to have settled with the vendors.

2. Mr. C. Mannington, of Park House, Northiam, Sussex, sent on December 7th, 1885, two samples of linseed-cake, upon which Dr. Voelcker reported:—

"December 15th, 1885.

	No. 1.	No. 2.
Moisture	11·72	10·87
Oil	10·10	12·06
*Albuminous compounds	26·75	20·81
Mucilage, &c.	35·26	35·80
Woody fibre	10·34	12·23
†Mineral matter	5·83	8·23
	100·00	100·00
* Containing nitrogen	4·28	3·33
† Including sand	..	3·39

"No. 1 is a pure cake, but No. 2, though it gives a good percentage of oil, is a grossly adulterated cake, containing a very large amount of locust-bean, and in addition niger-seed, polygonum, and starchy bodies. It is in consequence very poor in nitrogen.—Yours faithfully,

"J. AUGUSTUS VOELCKER."

Twelve tons of No. 2 cake had been purchased at 8*l.* 5*s.* per ton. In further reply, Mr. Mannington wrote :—

"As I did not buy it for 'pure' cake I do not think it right to give the agent's name. It is more adulterated than I expected, and I don't buy any more."

3. Mr. W. E. Hill, of Roche Abbey Farm, Rotherham, forwarded on December 12th, 1885, a sample of linseed-cake branded "pure," one ton having been bought at 8*l.* 1*s.* 6*d.* delivered.

Dr. Voelcker reported :—

Moisture	13·25
Oil	9·46
*Albuminous compounds	22·68
Mucilage, &c.	37·50
Woody fibre	8·16
†Mineral matter	8·95
	100·00
* Containing nitrogen	3·63
† Including sand	4·15

"A dirty impure cake of low quality. "J. AUGUSTUS VOELCKER."

This cake contained a large amount of polygonum-seed and starchy bodies, and tasted and smelt of rape-seed. In reply to further inquiries, Mr. Hill wrote :—

"December 19th, 1885.

"DEAR SIR,—In reply to yours I only had a ton of linseed-cake for trial, and, as the manufacturers are friends of mine, I do not care to expose them. I find they make a cake from seed of 95 per cent. purity. Of course I shall not have any more of the same brand.

"The invoice is written out "pure" linseed-cake.—I am, yours faithfully,

"W. E. HILL."

"Dr. J. A. Voelcker."

"P.S.—They argue that you call no cake pure except 95 per cent., from which you take your standard, and that this cake was made from screened linseed. The price was 7*l.* 15*s.* in Hull."

4. Mr. R. H. Ashton, of Castleton, by Sheffield, on January 11th, 1886, sent a sample of what was stated to be "bone-dust," the price asked being 5*l.* per ton delivered.

Dr. Voelcker reported as follows:—

"January 12th, 1886.

Water	12·78
*Organic matter	79·88
Phosphate of lime	·80
Carbonate of lime, &c.	6·30
Insoluble siliceous matter	·24
	100·00
* Containing nitrogen	·57
Equal to ammonia	·69

"This is not bone-dust at all, but almost worthless vegetable ivory.

"J. Augustus Voelcker."

Mr. Ashton subsequently wrote:—

"January 22nd, 1886.

"Sir,—I am much obliged for your letter containing analysis of so-called bone-dust. The result is just what I expected.

"Before sending sample to you, I had been in correspondence with my solicitor, so I have sent him invoice, &c., and am very much inclined to instruct him to take proceedings against the vendors. Should I find that he does not recommend me to take legal measures, I will write you again.

"The bone-dust was delivered and sown on the land whilst I was away from home, and on going over the land some time afterwards I found pieces of corozza-nuts that excited my suspicions, and fortunately I was able to obtain a sample from a neighbour who had some of the so-called bone-dust delivered the same day by the same parties.—I am, Sir, yours obediently,

"Robt. Hen. Ashton.

"Dr. J. Augustus Voelcker."

In consequence of Mr. Ashton's absence abroad no further action has been taken, and the vendor's name has not as yet been obtained.

5. Mr. R. L. Angus, of Acton Burnell, Shrewsbury, sent a sample of linseed-cake on February 22nd, 1886, the price being 8*l.* 17*s.* 6*d.* per ton, cash in three months.

Dr. Voelcker's analysis and report were:—

"February 26th, 1886.

Moisture	13·21
Oil	13·20
*Albuminous compounds	24·25
Mucilage, &c.	33·05
Woody fibre	7·87
†Mineral matter	8·42
	100·00
* Containing nitrogen	3·88
† Including sand	3·63

"A cake containing a considerable amount of impurity in the form of foreign seeds, starchy bodies, and sand. One I would not get at all, still much less pay 8*l.* 17*s.* 6*d.* per ton for. Was it sold as pure?

"J. AUGUSTUS VOELCKER."

On March 12th Mr. Angus wrote that the cake had been returned and all expenses were to be paid.

No names were, however, forthcoming.

JUNE 1886.

The Committee call attention to the first reported case as illustrating the prevalent and pernicious custom of manufacturers and dealers allowing commission to the servants of purchasers; and also as showing how very erroneous an impression may be given of the value of manures by the system of prizes when the manufacturers' own agents are allowed to compete for them. The Committee have not felt justified in giving the names in this case, as the transaction is now of somewhat remote date, although the inquiries which have elicited the facts have only recently taken place.

1. A sample of manure was sent for analysis on January 23rd, 1886, with the following letter:—

"DEAR SIR,—Your letter to me at home —— has been forwarded to me here.

"My agent, when he was down at my place about a week ago, suggested to me that he should send you the sample you refer to for analysis, being of opinion that I had been charged more than they were worth.

"The price was 8*l.* 8*s.* per ton, less 10 per cent. for cash, which I always pay for goods supplied to me—*i.e.* 7*l.* 11*s.* per ton, delivered at ——, and made in adjoining counties.

"Please send me your reply here.—I remain, yours very truly,

"Dr. J. Augustus Voelcker." "——."

Dr. Voelcker sent the following analysis and report:—

"February 2nd, 1886.

Moisture	8·54
* Organic matter and water of combination	29·63
Monobasic phosphate of lime	4·67
Equal to tribasic phosphate of lime (bone phosphate) rendered soluble by acid	(7·31)
Insoluble phosphates	22·98
Sulphate of lime, alkaline salts, &c.	29·20
Insoluble siliceous matter	4·98
	100·00
* Containing nitrogen	1·36
Equal to ammonia	1·65

"The prices are enormous. Surely there must be some mistake. Pray send me the invoices to look at. I cannot think these prices, 8*l.* 8*s.* per ton, could be charged.

"J. AUGUSTUS VOELCKER."

In a subsequent interview with the sender, Dr. Voelcker gave 5*l.* per ton as the approximate value of the manure.

It was invoiced as P.D. Bones at 8*l.* per ton.

Two tons were purchased on May 13th, 1885, from which the sample analysed was taken, but Mr. —— had been in the habit of having this same manure for the last three years—18 tons in all having been purchased. The invoiced price in 1883–4 was 8*l.* 10*s.* per ton, and 8*l.* in 1885.

The sender having reason to believe that his late bailiff had been receiving commission from the manufacturers, and finding also that discount had not been deducted from their bills, although he had given strict orders to his bailiff to pay cash for everything, instructed his agent to write to the firm on the matter, and he received the following letters:—

"February 2nd, 1886.

"Dear Sir,—In reply to yours respecting —— and receiving a percentage from us, we have to say that we allow him 5 per cent. as agent, and have done so for some time.

"At the same time Mr. —— has been allowed the full discount he was entitled to according to our trade terms.

"We may remark that —— acted as agent for us before he went into Mr. ——'s service. We trust this explanation will be satisfactory.

"We beg to enclose you our annual circular, and respectfully solicit your kind favours.—We are, yours truly, "——."

"February 9th, 1886.

"Dear Sir,—We are duly with yours in reply to ours of the 2nd.

"You say 'I cannot see in his accounts that you have allowed him the usual discount.'

"We repeat that 'Mr. —— has been allowed the full discount he was entitled to according to our trade terms.'

"We think it better to send you a fair copy of Mr. ——'s ledger account with us during the time he employed ——, and you will be enabled by this to form your own judgment.

"In the years 1883–84, credit was taken, and therefore the account was not subject to discount.

"Last year, 1885, the account shows discount for cash payment.

"We may mention that in the three past years prizes to the amount of 14*l* 14*s.* have been awarded to Mr. —— for successful root-growing, showing good crops. We thank you for forwarding our letter to Mr. ——, and shall feel obliged if you will also forward this, together with enclosed statement.—We are, yours truly, "——."

"February 15th, 1886.

"Dear Sir,—In reply to your favour as to whether the manures had from us in the years 1883–84, and charged at 8*l.* 10*s.* per ton, were of the same description and quality as that supplied in 1885 and charged at 8*l.* per ton, we beg to say the manures were the same, and that we reduced our price last year in common with other manufacturers, and to meet the bad times existing with farmers.

"Any further explanation we can afford you we shall be happy to give.—Yours truly, "——."

On February 28th, the sender wrote to the manufacturers :—

"February 28th, 1886.

"DEAR SIRS,—My bailiff has given me three letters received from you and a copy of my account with you for the last three years.

"I am very much surprised to learn that my bailiff, Mr. ——, was acting as your agent, and was receiving a commission of 5 per cent. from you upon goods supplied to him upon my account.

"My orders to —— were to buy and pay for everything in cash—he had always plenty of money for that purpose—and express instructions to avail himself of all discounts for immediate payment.

"I never knew that my bills were not settled in this manner with you; indeed they were, I have reason to believe, kept back by your agent, for whenever I was told that such bills were due I ordered them to be paid immediately.

"I find no discount allowed at all in 1883–4.

"The prizes to which you allude were of course handed over to ——.

"I was always opposed to his competing for them, and I am surprised that you should have allowed your own agent to enter for them, and I am afraid as far as the prize for mangolds in 1885 is concerned that he is hardly entitled to it.

"As your agent and my bailiff, ——, has so thoroughly deceived me in all matters connected with my farm, I have thought it right to send a sample of your manure to Dr. Voelcker for analysis.

"This he has sent me, and he reports the value to be about 5*l.* per ton, to which amount if we add 10*s.* for carriage and other expenses, would still be 2*l.* 10*s.* under the price paid you in 1883–4, and 1*l.* 14*s.* in 1885.

"I shall therefore feel obliged by your sending me a cheque for the difference, after deducting 12*l.* 8*s.* 5*d.* for nitrate of soda supplied in August last year, the bill for which your agent has not laid before me."

Fresh samples of the manufacturers' manure were taken on March 10th by their representative and the sender's present bailiff; these being drawn from ten different bags and sealed by either party, duplicates also being kept. These samples were taken, as the manufacturers contended that the previous one was not fairly representative, and the following letter was sent by them to the sender in reference to the re-sampling :—

"March 6th, 1886.

"DEAR SIR,—We beg to inform you that we have arranged with your Mr. —— to have the manure (now lying at ——) sampled on Wednesday next, the 10th instant, for analysis, in the presence of one of our representatives.

"One sample to be sent to Dr. Voelcker on your account, and a duplicate sample to be sent to either Mr. Alfred Sibson, F.C.S., 23, St. Mary Axe, London, or to Mr. Jno. Hughes, F.I.C., 79, Mark Lane, London, on our behalf. A sealed duplicate sample to be taken at the same time and kept for reference if necessary.

"We also send you by this post one of our pamphlets for 1885, containing, on page 20, our published conditions of analysis, which is marked for your information.—Yours truly, "——."

The fresh sample sent to Dr. Voelcker gave the following result :—

"March 17th, 1886.

"Sample, sealed March 10th, 1886.

Moisture	8·95
*Organic matter and water of combination	25·50
Monobasic phosphate of lime	3·12
Equal to tribasic phosphate of lime (bone phosphate) rendered soluble by acid	(4·88)
Insoluble phosphates	25·38
Sulphate of lime, &c.	30·82
Insoluble siliceous matter	6·23
	100·00
* Containing nitrogen	1·59
Equal to ammonia	1·93

"If anything, inferior to the previous sample.

"J. AUGUSTUS VOELCKER."

Subsequently the following letters were received :—

"March 30th, 1886.

"DEAR SIR,—In reply to yours of the 27th, we have been waiting the receipt of Dr. Voelcker's analysis and valuation from Mr. —— before writing you further. We understood our representative —— would be in receipt of it to-morrow at ——.

"We regret Dr. Voelcker's report, and can assure you that it is at all times our wish to send out goods of the full value charged for them.

"We will accept Dr. Voelcker's valuation upon the receipt of it, together with his analysis, and allow you the difference between it and *the price charged—viz. 8l. per ton* upon the quantity you used last year—viz., 6 *tons* 5 *cwt.* 2 *qrs.*, taking back the twenty-three bags still at —— weight, 1 *ton* 14 *cwt.* 2 *qrs.*, making the 8 tons we supplied you with.

"We trust you will think this perfectly satisfactory, and can only repeat our regret at the results of analysis, which please send us.

"Soliciting your future favours, which shall meet with our best attention.—We are, dear Sir, yours truly,

"——."

"April 2nd, 1886.

"DEAR SIR,—We are duly in receipt of yours of yesterday, and return you Dr. Voelcker's analysis and letters as requested.

"We herewith send statement showing the deductions we make to you upon the basis of Dr. Voelcker's analysis *and valuation* of the manure supplied you, and we thank you for the settlement.

"We shall feel much obliged to you if you will be good enough to send us the *standard of value* as used by Dr. Voelcker for our information, as we are at a loss as to his calculations of value.

"The cost of carriage was 8*s.* 2*d.* per ton on the manure, 5 per cent. commission equal 8*s.*, and discount 1*l.*; total charges 1*l.* 16*s.* 2*d.*, leaving 6*l.* 3*s.* 10*d.* net to the firm; and Mr. ——, who was in one of the first laboratories in London, has gone into the analysis of this manure, when sent out, and finds it :—

Soluble phosphates	12·50
Insoluble phosphates	10·87
	23·37
Nitrogen equal to ammonia	2·22

and can only come to one conclusion in the matter, and that is, that the *soluble* phosphate must have *become precipitated*, as it appears to have gone back by lying some time, viz., 7·62 per cent., the ammonia in it when sent out was 2·22 per cent.

"We send you a copy of our guarantees, wherein you will see that the manure *as sent out* is equal to them.

"Will you oblige us by sending this letter also to Dr. Voelcker for perusal?—We are, dear Sir, yours truly, "——."

"We can assure you that we are great losers by the transactions."

Credit Note.	£	s.	d.
Allowed on 6 tons 5 cwt. 2 qrs. at 2*l.* equal (as per Dr. Voelcker's estimate)	12	11	0
To return, 1 ton 14 cwt. 2 qrs. at 8*l.*, equal ..	13	16	0
	26	7	0

	£	s.	d.	
N.B.—The manure was charged at	8	0	0	per ton
8 tons had, with 12½ per cent. off, equal ..	1	0	0	„
	7	0	0	net.

This was an inferior manure, not worth 5*l.* per ton.

2. On March 1st Mr. Edmund Cavell, of Saxmundham, sent a sample of what was called "Organic Manure," of which he had purchased 5½ tons at 2*l.* a ton, with 10 per cent. special discount for prompt cash, carriage 9*s.* a ton extra, from Messrs. Hamilton & Co., 118, High Street, Wandsworth, London, S.W., and 6, Gratton Road, Hammersmith, W. A circular sent by the vendors described the manure as being a dry powder made from London sewerage, and equalled only by the celebrated Peruvian guano, which costs six times as much. It also gave the following statement:—

"Organic Manure—Analysis.

"Made by the well-known chemists, Messrs. Herring & Co., Aldersgate Street, London.

Organic matter	25·0
Soluble phosphates, &c.	19·5
Alkaline salts	23·5
Silica	7·5
Moisture	24·5
	100·0

"Ammonia 1·49 per cent. as given in another analysis by Prof. E. Kinch, F.C.S., F.I.C., &c., of the Royal Agricultural College, Cirencester."

With the circular this letter was sent:—

"From HAMILTON & Co., 118, High Street, Wandsworth, London, S.W.	February 1st, 1886. To E. CAVELL, Esq., Saxmundham.

Inventors and Manufacturers of the celebrated Organic Manure; and "Carbolica," an improved Carbolic Disinfectant in pink powder or fluid. Manufactory and Wharf: Point Pleasant, Wandsworth, London, S.W.

"Dear Sir,—In reply to your letter of 30th Jan., we enclose circular giving full particulars of analysis, ammonia, &c. We shall be glad to be favoured with your reply to our special offer of six tons Organic Manure.—Yours faithfully, "Hamilton & Co."

Dr. Voelcker's analysis and report were:—

"March 13th, 1886.

Moisture	70·43
*Organic matter	22·02
Oxide of iron and alumina	1·04
Phosphate of lime	trace
Carbonate of lime	2·89
Alkalies, &c.	1·58
Sand	2·04
	100·00
* Containing nitrogen	·69
Equal to ammonia	·84

"This manure you will see has but a trace of phosphates, so that the 19·5 per cent. stated on the analysis Messrs. Hamilton & Co. give is made up, not of soluble phosphates, but of worthless '&c.,' whatever that may be. The alkaline salts are 1½ per cent. instead of 23·5 per cent., and instead of only 24·5 per cent. of moisture you have the very doubtful advantage of having 70 per cent. of water to pay carriage for. May I ask if the analysis was guaranteed? "J. Augustus Voelcker."

On March 14th and 18th, Mr. Cavell wrote:—

"On receipt of your analysis, which proves the gross inaccuracy of the description, particularly in the phosphates and alkalies, I wrote declining the manure, and have returned it.

"The public, as well as myself, are interested in resisting such an imposition.—Yours very truly, "Edmund Cavell."

"On the arrival of the material, as it had the appearance of soot, I wrote, 'I did not want soot, having ordered some. I had ordered of them London sewerage, and the manure sent had not the appearance of London sewerage. I should, therefore, have it analysed and would write them on the receipt of analysis.'

"I have not paid them any money, and shall want all the papers and letters for my defence on any action brought for the money.

"I do not know whether you purpose taking any steps of exposure or otherwise, but I think it will be better to wait and see what they will do.—I am, dear Sir, yours faithfully, "EDMUND CAVELL."

The vendors wrote as follows:—

"March 12th, 1886.

"DEAR SIR,—We duly received your letter of the 8th inst. You need not be afraid we have supplied you with all 'soot;' we could not afford it at the price. You will recollect that the terms on which we supplied this manure were *very special*, and we even paid carriage on it to save you trouble; the price was for *prompt cash* on delivery. Kindly, therefore, let us have your cheque by return of post, and so oblige yours faithfully,

"HAMILTON & CO."

"Your letter of 5th February promised prompt cash, we therefore rely on you to send it at once."

In reply to further inquiries as to how the matter had been settled, Mr. Cavell wrote:—

"Saxmundham, May 31st, 1886.

"ORGANIC MANURE, No. 378.

"DEAR SIR,—I have not had to pay for the above, nor have any steps been taken with the view to compel payment.—Yours faithfully,

"Dr. J. Augustus Voelcker. "EDMUND CAVELL."

3. On March 31st Mr. W. H. Goodall, of Stoke Grange, Market Drayton, sent a sample of steamed bones. Five tons twelve hundredweight were purchased at 4*l.* 15*s.* a ton, a contract being made for 30 tons. Dr. Voelcker's report and analysis were:—

Water	13·31
*Organic matter	22·73
Phosphate of lime	47·35
Carbonate of lime, common salt, sulphate of lime, &c.	16·01
Sand	·60
	100·00
*Containing nitrogen	1·30
Equal to ammonia	1·57

"This is not a pure sample of bones, as it contains both salt and sulphate of lime to some extent. Was it sold as pure?

"J. AUGUSTUS VOELCKER."

Mr. Goodall replied:—

"Stoke Grange, Market Drayton, April 15th.

"The bones were bought as pure, at 4*l.* 15*s.* per ton, at Drayton Station. I saw the vendor yesterday; he will allow for the difference in value; will you please state what they are worth according to your analysis? I bought 30 tons, and shall have a six-ton lot next week and send a sample to you."

To this Dr. Voelcker replied that 10*s.* a ton would be a fair allowance to make, and Mr. Goodall wrote on May 31st:—

"Stoke Grange, May 31st.

"DEAR SIR,—In answer to yours, —— promised to allow the difference in value of the bones as per your analysis, and the guarantee I received when I made the contract, but I was not to pay until three months from date of contract, and by that time I shall have had all I require for this season, and I have no doubt they will act fairly.—I am, yours truly,

"W. H. GOODALL."

DECEMBER 1886.

1. Mr. J. H. Kemp, of Walton, Wellington, Salop, forwarded on May 22nd, 1886, a sample of what had been sold to him as pure dissolved bones, price 8*l.* per ton, less 10 per cent. discount. On this Dr. Voelcker reported as follows:—

"June 1st, 1886.

Moisture	12·27
*Organic matter and water of combination	19·60
Monobasic phosphate of lime	15·88
Equal to tribasic phosphate of lime (bone phosphate) rendered soluble by acid	(24·85)
Insoluble phosphates	7·19
Sulphate of lime, alkaline salts, &c.	37·52
Insoluble siliceous matter	7·54
	100·00
* Containing nitrogen	1·50
Equal to ammonia	1·82

"This is not dissolved bones at all, but bone ash superphosphate, with the addition of some nitrogenous material. The price is very excessive.

"J. AUGUSTUS VOELCKER."

On June 19th, Mr. Kemp wrote:—

"DEAR SIR,—I have seen the vendor about the manure which you sent me particulars about on the 1st inst. It seems the manure was sent in a mistake, and he agreed to lower the price for what was delivered to 4*l.* per ton, so I think that will be worth the money.—Yours respectfully,

"Dr. J. A. Voelcker. "J. H. KEMP."

The name of the vendor was not forthcoming.

2. Mr. John Mackrory, of Lilleshall Estate Office, Newport, Salop, sent on May 20th, on behalf of His Grace the Duke of Sutherland, a sample of boiled bones. Fourteen tons had been purchased at 4*l.* 15*s.* per ton, less 5*s.* per ton for cash, in three months, from the manufacturers, through their agents.

"Lilleshall Office,
"March 22nd, 1886.

"DEAR SIRS,—Be so good as to send to Newport Station, addressed to Mr. Billington, Little Hales Farm, 14 tons of pure boiled bones ground ¼ in. to fine and of guaranteed quality; advise him when sent away, and forward account for the same to me.—Yours faithfully, "JOHN MACKRORY."

Dr. Voelcker's analysis and report were:—

"June 1st, 1886.

Moisture	20·10
*Organic matter	16·20
Phosphate of lime	51·63
Carbonate of lime, common salt, &c.	10·97
Sand	1·10
	100·00
* Containing nitrogen	1·21
Equal to ammonia	1·47

"This is of somewhat poor quality and contains some amount of salt.

"J. Augustus Voelcker."

The amount of salt found was 4·20 per cent.

On Mr. Mackrory asking the value of the steamed bones, Dr. Voelcker wrote:—

"July 5th, 1886.

"Dear Sir,—The steamed bones ought to have about 60 per cent. of phosphate of lime, and I should be inclined to claim at least 10*s.* a ton for the deficiency.—Yours faithfully, "J. Augustus Voelcker."

"J. Mackrory, Esq."

In reply to later inquiries, Mr. Mackrory, on December 6th, informed Dr. Voelcker that the allowance agreed to in regard to the bones was 6*s.* per ton.

3. Mr. W. Wyley, of 2, School Chambers, Shrewsbury, sent on April 3rd, with other samples, one of steamed bones guaranteed to contain 56 per cent. phosphate of lime and 1·40 per cent. ammonia, the price being 4*l.* 10*s.* per ton. Dr. Voelcker's report was:—

"April 14th, 1886.

Water	15·09
*Organic matter	19·49
Phosphate of lime	49·73
Carbonate of lime, common salt, &c.	14·70
Insoluble siliceous matter	0·99
	100·00
* Containing nitrogen	1·50
Equal to ammonia	1·82

"This is not a pure sample, but contains some quantity of salt. Was it sold as pure? "J. Augustus Voelcker."

Dr. Voelcker endeavoured to elicit information, but without success.

4. Mr. H. Hedges, of Park View, Whitchurch, Salop, sent on April 29th a sample of bones bought at 4*l.* 10*s.* per ton, and also on May 14th a second sample, marked "Park View." These Dr. Voelcker analysed, giving the following reports:—

"May 10th, 1886.

"BONES.

Water	8·63
*Organic matter	18·31
Phosphate of lime	39·98
Carbonate of lime	30·15
Alkaline salts, &c.	1·03
Sand	1·90
	100·00
* Containing nitrogen	1·29
Equal to ammonia	1·56

"This sample is largely adulterated with carbonate of lime (chalk).

"J. AUGUSTUS VOELCKER."

"May 26th, 1886.

BONES.—"Park View."

Moisture	18·49
*Organic matter	16·14
Phosphate of lime	50·33
Carbonate of lime, common salt, &c.	14·34
Insoluble siliceous matter	·70
	100·00
* Containing nitrogen	1·14
Equal to ammonia	1·39

"This is not a pure sample, but contains some amount of admixture in the form of common salt. "J. AUGUSTUS VOELCKER."

The sample marked "Park View" contained 5·95 per cent. of salt.

Mr. Hedges asking an opinion of the market value, Dr. Voelcker wrote, May 20th:—

"Taking into consideration the fact that the bones, if pure, would contain about 60 per cent. of phosphate of lime, you would be, I think, justified in claiming a reduction of at least 1*l*. per ton for the difference, provided you bought the bones as a pure article. Will you kindly fill up and return to me the form I lately forwarded?—Yours faithfully,

"J. AUGUSTUS VOELCKER."

The following letter then passed:—

"Dr. J. A. Voelcker,
"12, Hanover Square, W. July 21st, 1886.

"DEAR SIR,—In reply to yours, I am wishful to give you every information in regard to the bones sent you for analysis; and further to say that the firm having agreed to your opinion, and having behaved in a handsome way, I would much prefer not to mention names.

"Hoping this will be satisfactory to you,—I remain, yours truly,

"H. HEDGES."

5. Mr. Edward Blundell, of Birchmoor, Woburn, sent on May 29th, a sample of undecorticated cotton-cake, of which he

had purchased three tons from a dealer in Bedford, the price being 5*l.* 7*s.* 6*d.* per ton delivered.

Mr. Blundell wrote :—

"I am afraid it is not A 1, as I often find foreign matter in it, such as iron, stones, &c."

Dr. Voelcker's report was :—

"June 8th, 1886.

Moisture	13·95
Oil	4·37
*Albuminous compounds (flesh-forming matters)	23·12
Mucilage, sugar, and digestible fibre	27·56
Woody fibre (cellulose)	24·30
Mineral matter (ash)	6·70
	100·00
* Containing nitrogen	3·70

"DEAR MR. BLUNDELL,—This is a nasty and very badly-made cake, one not at all safe to use for feeding purposes. It is full of cotton fibre and wool, and this has a great tendency to collect in the stomach and cause stoppage. I should not use it on any account. "J. AUGUSTUS VOELCKER."

When Mr. Blundell complained of the cake, the manufacturers were not willing to allow anything, but ultimately the dealer deducted 1*l.* per ton from the account, and Mr. Blundell wrote :—

"I do not blame the dealer at all in the matter, but I think the manufacturers did not act liberally when the evidence against that particular lot was so clear."

6. Mr. C. Walker, of Southfields, Coleshill, near Birmingham, purchased in July three tons of undecorticated cotton-cake at 5*l.* 12*s.* 6*d.* per ton from an agent of the manufacturer. After sending a sample for examination on August 2nd, he received the following analysis and report :—

"August 10th, 1886.

Moisture	11·29
Oil	5·77
*Albuminous compounds	23·12
Mucilage, &c.	32·05
Woody fibre	21·13
Mineral matter (ash)	6·64
	100·00
* Containing nitrogen	3·70

"A cake full of cotton wool; one I would not think of using. I should consider it dangerous to give to stock. Where did you get it from ?"

Mr. Walker wrote subsequently, saying that the agent had shown him a letter from the manufacturer stating that the cake would not be injurious, but that it was not crushed so finely as some, and mentioned the kind of seed the cake was made of (Smyrna). The matter was settled by the agent making a reduction.

7. Mr. J. Body, of Wittersham, Kent, sent on May 28th a sample of nitrate of soda.

On analysis this gave the following results:—

"June 8th, 1886.

Water	2·75
Chloride of sodium	28·16
Other impurities	·57
Pure nitrate of soda	68·52
	100·00

"A sample adulterated with 28 per cent. of common salt.

"J. Augustus Voelcker."

In answer to inquiries, Mr. Body wrote:—

"July 10th, 1886.

"Dear Sir,—With regard to the nitrate of soda you analysed for me on the 8th June, it was a small lot of 15 cwt. sent for by my bailiff; it is the first lot I ever had from this firm, and it will be the last, but I have promised not to go forward in the matter, so cannot give up his name.—Yours faithfully, "John Body, Jun."

"Dr. J. A. Voelcker."

8. Mr. D. Davison, of Sedgefield, Ferry Hill, sent on June 2nd a sample of sewage manure. The quantity purchased was 5 tons 16 cwt., in bags, at 2*l.* per ton, besides carriage, Mr. Davison's intention being to use it for swedes. This was invoiced as "Organic manure," and was bought from Messrs. Hamilton & Co., 118, High Street, Wandsworth, S.W., the manufacturers. A circular sent to Mr. Davison described the "Organic manure" as "a dry powder manufactured from London sewage, &c." . . . "A manure with the highest fertilising properties, and far superior to other manures. It is equalled only by the celebrated Peruvian guano, which costs six times as much. It is unequalled for cereals, grass, roots, hops, &c." . . . "Where once used the beneficial effects are visible for several seasons." . . . "The organic manure is the latest advance made in manures. It contains a large percentage of organic matter, ammonia, and phosphates." The following analysis was also given in the circular:—

"ORGANIC MANURE ANALYSIS

"Made by the well-known chemists, Messrs. Herrings & Co., Aldersgate Street, London.

Organic matter	25·0
Soluble phosphates, &c.	19·5
Alkaline salts	23·5
Silica	7·5
Moisture	24·5
	100·0

"Ammonia 1·49 per cent. as given in another analysis by Prof. E. Kinch, F.C.S., F.I.C., &c., of the Royal Agricultural College, Cirencester."

Dr. Voelcker's report with the analysis was:—

"June 10th, 1886.

Moisture	48·35
*Organic matter and salts of ammonia	22·11
Phosphate of lime	1·67
Carbonate of lime	10·76
Magnesia, alkalies, &c.	6·68
Sand	10·43
	100·00
* Containing nitrogen	·66
Equal to ammonia	·80

"You have just about twice as much *useless* water as the published analysis states the manure contains, and about half as much *useful* ammonia. Instead of 19½ per cent. of phosphates you have only 1½ per cent., so that I suppose the remaining 18 per cent. is '&c.' (but I do not think the '&c.' will do your field much good!) Your 2*l.* per ton is not well expended in purchase of such poor stuff. "J. AUGUSTUS VOELCKER."

After some correspondence this case was closed by the receipt of the following letter:—

"From Hamilton & Co., 118, High Street, Wandsworth, London, S.W.

"To D. Davison, Esq.,
"Sedgefield, Ferry Hill, Co. Durham. "July 16th, 1886.

"DEAR SIR,—Referring to your letter of the 12th inst., we hear with surprise and regret such a bad account of the manure we had the pleasure of supplying to you. We have been looking into the matter at our works, but are unable to trace how the mistake occurred. We do not see how you arrive at the amount of 7*l.* 16*s.*, but we beg leave to enclose cheque for 6*l.*, which we trust you will accept in settlement of the matter, as the season is now too far advanced for us to replace the manure with other of the usual quality. Our manure has been tried against other special turnip manures with such advantage that we receive unsolicited testimonials to its value. The wet weather, doubtless, accounts for the extra moisture, but the phosphates were evidently omitted through some blunder.

"Apologising for the trouble inadvertently given you, and hoping to be favoured with your orders next season,—We remain, yours truly,

"HAMILTON & Co."

9. Mr. Henry Watson, of Merrington Grange, Ferry Hill, sent on June 12th, 1886, a sample of dissolved bone, "price 7*l.* delivered, guaranteed pure," upon which Dr. Voelcker reported as follows:—

"June 22nd, 1886.

Moisture	14·39
*Organic matter and water of combination	30·55
Monobasic phosphate of lime	13·66
Equal to tribasic phosphate of lime (bone phosphate) rendered soluble by acid	(21·38)
Insoluble phosphates	3·04
Sulphate of lime, alkaline salts, &c.	34·52
Insoluble siliceous matter	3·84
	100·00
* Containing nitrogen	2·91
Equal to ammonia	3·53

"This is not a pure sample of dissolved bone, but is one made up with sulphate of ammonia, which gives the high percentage of ammonia shown in the analysis.

"J. Augustus Voelcker."

In answer to inquiries, Dr. Voelcker was unable to obtain the name of the vendors or any further particulars.

10. Mr. Thomas Mansell, of Harrington Hall, Shifnal, sent on June 10th, 1886, a sample of manure invoiced "Swede Manure," 1 ton 1 cwt. of which he had purchased at 4*l.* 10*s.*, less 5 per cent. for cash, from the Manchester Phosguano Company, Limited, 13, Norfolk Street, Manchester, through an agent. The Company sent Mr. Mansell a circular, in which was the statement:—"All the Company's manures are sold subject to guaranteed analyses." The following was the analysis given of the swede manure:—

"Analysis by Mr. W. S. Spencer, Analyst, Manchester:—

Lime	28·70
Potash	8·40
Soda	1·61
Phosphate	13·00
Sulphuric acid, as sulphate of lime	3·81
Carbon, organic matter, &c.	8·00
Sulphate of ammonia	6·50
Carbonic acid, alumina, sulphide of calcium	23·38
Sand and silica	4·50
Water	2·10
	100·00"

Dr. Voelcker's report on Mr. Mansell's sample was, however:—

"June 22nd, 1886.

Moisture	3·84
*Organic matter	7·83
Phosphate of lime	4·97
Sulphide and carbonate of lime	63·94
Magnesia, alkalies, &c.	13·28
Sand	6·14
	100·00
* Containing nitrogen	·17
Equal to ammonia	·21

"This is miserable stuff, and 4*l.* per ton is an extravagant price for it. It may be worth something for liming purposes, but that is about all, and you could get gas-lime for that use and at a cost of only a few shillings a ton. This indeed appears to me to be waste from gas or alkali works; 12*s.* a ton would be its outside value to you delivered free.

"J. Augustus Voelcker."

After some correspondence, on July 16th, Mr. Mansell enclosed a copy of the following letter received from the manufacturers:—

"Dear Sir,—In reply to your letter of yesterday we have to remind you that in our letter of the 26th June we asked you to send us the chemist's analysis, or a copy thereof. What you have sent us is merely your chemist's opinion of our manure, and as we understand he is largely employed by other rival companies his opinion appears to us to be anything but an impartial one, and is ridiculous on the face of it. However, we can easily understand how you feel in the matter, and are agreeable that you should keep the manure for us until the autumn, when we will dispose of it elsewhere.

"Manchester Phosguano Co."

"13, Norfolk Street, Manchester."

Mr. Mansell stated that he would consider the matter settled by the Company carting the manure away at their own expense; but up to January 27th, 1887, this had not been done.

11. On June 4th, Mr. R. L. H. Phipps, of Leighton, Westbury, Wilts, sent a sample of oil-cake for analysis, stating that he had lost some lambs by diarrhœa; they had been taken suddenly ill, and had died in a very short time. An opinion only being required, Dr. Voelcker reported that the cake was not pure, and advised that further analysis should be made.

This analysis and report is given below:—

"June 22nd, 1886.

Moisture	11·48
Oil	10·03
*Albuminous compounds (flesh-forming matters)	20·08
Mucilage, sugar and digestible fibre	37·45
Woody fibre (cellulose)	9·13
†Mineral matter (ash)	11·83
	100·00
* Containing nitrogen	3·53
† Including sand	5·94

"An impure cake, containing impurities of a starchy character, and in addition 6 per cent. of sand, which I consider highly objectionable and frequently harmful. "J. AUGUSTUS VOELCKER."

Two tons of this cake had been bought on May 10th, at the price of 9*l*. 5*s*. per ton, from the Bridgwater and West of England United Farmers' Pure Linseed and Cotton Cake Company (Limited), Bridgwater. The following correspondence ensued:—

"July 6th, 1886.

"The Bridgwater and West of England United Farmers' Pure Linseed and Cotton Cake Company (Limited).

"GENTLEMEN,—I have to inform you that as my lambs were eating the last lot of linseed-cake supplied to me by you they were attacked by diarrhœa, which caused the death of eleven of them. I stopped giving the cake (whereupon the others immediately recovered), and I sent some of the cake to the Royal Agricultural Society's chemist, who returned a most unsatisfactory analysis, saying that it contained sand, 'Was an impure cake containing impurities of a starchy character, and in addition 6 per cent. of sand, which I consider highly objectionable and frequently harmful.' The sentence between inverted commas is *verbatim*.—I remain, yours faithfully,

"R. L. H. PHIPPS."

"Memorandum from The Farmers' Pure Cake Company (Limited), Bridgwater.

"To R. L. H. Phipps, Esq., Leighton. July 7th, 1886.

"DEAR SIR,—Yours to hand, and we are much surprised at the contents, having sold this year increased quantities of linseed-cake over last, and having from repeated analyses and from the testimony of consumers, some of whom have furnished us with either a complete analysis, or with a report from an analysis, and which has in every case been favourable. We are therefore the more astonished at your report. As to the diarrhœa among the lambs, may we ask whether the weather was wet or grass quick at the time; as the cake was forwarded to you on May 10th, we assume there is some probability of this, and if so this would be sufficient to account for the disease, as linseed-cake should not be used under such conditions. The other points would be the analysis being unsatisfactory, but we have on a former occasion heard the same report (it is now about four years ago), and was perfectly *bonâ fide* on the part of our consumer, but on further investigation the analyst (one of the two or three leading names in this country) withdrew the report and substituted one that was favourable, some error having been discovered. We are quite confident that our article deserves the high character it has obtained, and that this unfortunate loss, which we deplore, has nothing whatever to do with the quality. May we ask you to kindly furnish us with a copy of the analysis referred to?—Yours truly, "EDWIN BROWN, Manager."

"Memorandum from The Farmers' Pure Cake Company (Limited), Bridgwater.

"To R. L. H. Phipps, Esq., Leighton. August 14th, 1886.

"DEAR SIR,—Your favour to hand with enclosure, for which we thank you. In the many analyses of our own cakes which we have had, there is not one that compares with this except in oil, the fat and flesh formers according to your analysis being $2\frac{1}{2}$ per cent. to 3 per cent. below our usual analysis, whilst the mineral matter and woody fibre are 6 per cent. more. This appears quite incomprehensible to us, and we are accordingly having an analysis made

for our own satisfaction. Absolute purity is, we think, absolutely impossible. The percentage of sand in our last test was 4·09, and we hardly expect to get below this. We trust your confidence will be renewed and your orders again placed with us, believing that we give as good an equivalent in value as any firm of crushers in the trade.—Yours truly,

"Edwin Brown, Manager."

Following these letters came three demands for payment, and ultimately Mr. Phipps paid the account on October 1st. Mr. Phipps stated that he relied upon the name of the Company, "Pure Linseed and Cotton Cake Company, Limited," and had always their best cake, but did not take care that the invoice should describe it as "pure."

12. Mr. E. H. Warner, of the Elms, Loughborough, sent on May 6th a sample of linseed-cake for opinion. This Dr. Voelcker reported on as being a very impure and inferior cake, and advised a full analysis of it being made. Mr. Warner sent on May 11th for analysis another piece of the same cake. The analysis and report were:—

"May 22nd, 1886.

"Linseed-cake.

Moisture	10·01
Oil	9·83
*Albuminous compounds (flesh-forming matters)	23·19
Mucilage, sugar, and digestible fibre	31·36
Woody fibre (cellulose)	9·60
† Mineral matter (ash)	16·01
	100·00
* Containing nitrogen	3·71
† Including sand	10·10

"This cake is very impure, it has over 10 per cent. of sand, and a large quantity also of starchy impurities. It is low in albuminous compounds.

"J. Augustus Voelcker."

One ton of this cake was purchased at 8*l.* 5*s.* a ton from Messrs. W. J. Cotton, Fennel Street, Loughborough, the word "pure" being stamped on each cake. Mr. Warner had been in the habit of getting a cake called "D.S. Pure," and had ordered from Messrs. Cotton "the same cake as before." On inquiry, he found that a different cake and not the D.S. Pure had been sent, though the same price was charged and each cake branded "pure." Messrs. Cotton, in explanation, stated that they bought 2 tons casually from a traveller whom they had not previously dealt with, and the one ton sent to Mr. Warner was a portion of this. They did not know the manufacturer, but promised to find out. This information, they say, they have been unable to procure. Mr. Warner paid Messrs. Cotton

half-price for 12 cwt. of the cake, which had been used before the analysis was received, and returned the remaining 8 cwt.

13. On August 24th, Mr. W. H. Phillips, of Woodhouse, Aldford, Chester, sent for analysis a sample of linseed-cake purchased by the Hon. C. T. Parker, Eccleston, Chester, on behalf of His Grace the Duke of Westminster, K.G. Two tons of this cake had been purchased from Messrs. S. Downes and Co., the Albany, Liverpool, on August 18th, at the price of 7*l.* 10*s.* per ton, the cakes being invoiced "English Pure Linseed-cake." The manufacturers were Messrs. E. and W. Pearson, Exchange Street East, Liverpool, each cake being branded "Pearson's Pure."

Dr. Voelcker's analysis and report were:—

"August 27th, 1886.

"LINSEED-CAKE.

Moisture	11·55
Oil	7·10
*Albuminous compounds (flesh-forming matters)	25·44
Mucilage, sugar, and digestible fibre	35·81
Woody fibre (cellulose)	9·60
†Mineral matter (ash)	10·50
	100·00
* Containing nitrogen	4·07
† Including sand	4·95

"A very poor cake and not pure. It is low both in oil and in nitrogen, and has a considerable amount of sand.

"J. AUGUSTUS VOELCKER."

A long correspondence ensued, which was closed by the following letter:—

"From S. Downes & Co., General Brokers,
"132, The Albany, Liverpool,
"October 19th, 1886.

"Mr. W. H. Phillips.

"SIR,—We duly received your favour of the 13th, which we placed before the makers, and we have the pleasure of informing you that they agree to forego the balance 3*l.* 1s. 10*d.* due on invoice after deducting your charges. This settlement will meet your views, and we trust will recompense you for any deficiency in the quality of the small quantity of cake consumed. Enclosed please find statement.—We are, Sir, your obedient servants,

"SAMUEL DOWNES & Co., per H. D. JONES."

14. Mr. B. Bryant, of Berwick, Bridport, Dorset, sent on September 1st a sample of manure with the following letter:—

"September 1st, 1886.

"DEAR SIR,—I send you a parcel of stuff sold to me as manure for turnips, at 3*l.* per ton, but it has done my swedes and turnips harm instead of good. Will you kindly tell me the cause, and also if there is any value in it as a manure.—Yours faithfully,

"B. BRYANT."

"Dr. J. Augustus Voelcker."

Dr. Voelcker's report was :—

"September 16th, 1886.

Water	3·49
*Organic matter and loss on heating	22·23
Oxide of iron and alumina	10·43
Phosphate of lime	none
Insoluble siliceous matter	41·50
Carbonate of lime, sulphate of lime, alkalies, &c.	22·35
	100·00
* Containing nitrogen	0·97
Equal to ammonia	1·17

"Such a manure as this has not only hardly any worth in respect of the small fertilizing properties it contains, but is in my opinion, by reason of the presence of sulphides, an objectionable manure altogether to use in its present condition. "J. Augustus Voelcker."

Five tons had been purchased on June 14th, under the name of the Kimmeridge Animal Shale Manure, from the Kimmeridge Oil and Carbon Company, Limited, Sandford, Wareham, Dorset.

Mr. Bryant wrote subsequently :—

"I paid 2*l*. 10*s*. 10*d*. for carriage of 5 tons to West Bay, Bridport; it did me more harm than good. I drilled it same as other manure with ashes in the middle of an 18-acre piece of swedes, and you can see to a drill either side. I also drilled 6 acres of turnips with the stuff mixed with ashes, and they are also a failure. I did not use any more of the stuff as I found it no good. I have complained and have got put off from time to time; at one time they would come and see for themselves, but at last they send me a letter (received to-day) of which I send you a copy. It seems to me a poor recompense for loss of crops. Is there a remedy, or must I grin and bear it?—Yours faithfully, "B. Bryant."

"I send you their pamphlet for perusal, but should like to have it again when done with. I have also an analysis of the same stuff by Alfred Sibson, F.C.S., which closely corresponds to your own."

"October 4th, 1886.

"Dear Sir,—Referring to your post-card of the 24th ult., I beg to enclose you copy of resolution passed by my Board of Directors at their meeting to-day.

"Resolution.—'That the Board will under the circumstances forego the charge for the quantity of manure he has used, but at the same time, they desire Mr. Bryant to understand that their shale is without doubt an excellent manure—*when properly applied*, having the testimony of Canon Hole and others to that fact. It follows therefore that the Board distinctly decline to give Mr. Bryant any compensation for the alleged loss of crops. As to the quantity that has not been used Mr. Bryant to be asked to return it to the Sandford Works, carriage paid. Regarding Mr. Bryant's threat of his sending a report to Dr. Voelcker, the Board wish to observe that Mr. Bryant is, of course, at liberty to send any report of his to whomsoever he pleases.'—Yours faithfully, "Chas. Beaumont, Manager."

15. Mr. G. W. Weston, of Hemblington, Norwich, sent on October 26th a sample of linseed-cake. Of this he had purchased four tons on October 5th, at 7*l.* 17*s.* 6*d.* per ton. This cake was supposed to be a Russian cake. It was recommended by the vendors as being good and pure, and was stamped:—

HARBURGER
OELFABRIK
F. THÖRL.

Dr. Voelcker's analysis and report were as follows:—

"November 1886.

Moisture	13·15
Oil	9·03
*Albuminous compounds (flesh-forming matters)	24·37
Mucilage, sugar, and digestible fibre	34·54
Woody fibre (cellulose)	12·44
Mineral matter (ash)	6·47
	100·00
* Containing nitrogen	3·90

"This is a cake of rather low quality and is not pure. It contains some amount of rape-seed. Was it sold to you as "pure"?

"J. Augustus Voelcker."

No guarantee had been given in this case.

16. Mr. H. Rogers of Cheswell Grange, Newport, Salop, sent on November 9th a sample of linseed-cake for opinion of genuineness, describing it as a sample of "City" oil-cake, of which four tons had been ordered at 8*l.* per ton, delivered.

Dr. Voelcker wrote in reply:—

"Henry Rogers, Esq. November 12th, 1886.

"Dear Sir,—My opinion of the linseed-cake you have sent me is that it is a very dirty and impure cake. If you have purchased any of it, I would advise you to have a full analysis of it made, as it seems to me a decidedly bad cake.—Yours faithfully, "J. Augustus Voelcker."

The following letters passed:—

"From Henry Rogers, Cheswell Grange, Newport, Salop.

"November 22nd, 1886.

"I returned the oil-cake to agent, so shall do nothing more with it.

"H. R."

"November 26th, 1886.

"Dear Sir,—You did well in refusing to take the cake. I am asking you if you would kindly fill up the enclosed form and obtain the particulars;

for I find the cake is a very bad one, and I think it would be doing a benefit, that others as well as yourself should be put on their guard against buying such cake.—Yours faithfully, "J. AUGUSTUS VOELCKER."

Though Mr. Rogers did not ask for it, Dr. Voelcker, for his own satisfaction, made an analysis of this cake, which gave the following results:—

Moisture	13·22
Oil	14·23
*Albuminous compounds (flesh-forming matters)	23·56
Mucilage, sugar, and digestible fibre	28·30
Woody fibre (cellulose)	7·17
† Mineral matter (ash)	13·52
	100·00
* Containing nitrogen	3·77
† Including sand	7·43

The cake contained oats, foreign seeds, and a quantity of starchy matters, besides over 7 per cent. of sand, indicated in the analysis.

17. Mr. C. W. Lister Kaye, agent to Mr. F. J. Savile-Foljambe, Osberton, Worksop, sent on November 19th two samples of linseed-cake marked No. 1 and No. 2. The analyses and reports on these were:—

"November 23rd, 1886.

	No. 1.	No. 2.
Moisture	14·01	13·50
Oil	7·60	10·93
*Albuminous compounds (flesh-forming matters)	24·37	24·01
Mucilage, sugar, and digestible fibre	31·85	35·72
Woody fibre (cellulose)	9·86	9·83
† Mineral matter (ash)	12·31	6·01
	100·00	100·00
* Containing nitrogen	3·90	3·84
† Including sand (average of duplicate determinations)	6·54	0·65

"No. 1 is a very poor quality cake, and has a considerable admixture of sand. No. 2 is a richer cake, but is hardly as free from foreign seeds as it should be. "J. AUGUSTUS VOELCKER."

Mr. Lister Kaye further sent on November 29th a third sample, stating that it was from the same maker as sample No. 1, previously analysed, No. 2 being from a different maker altogether. The analysis and report on this one was:—

"December 6th, 1886.

Moisture	13·83
Oil	8·31
*Albuminous compounds (flesh-forming matters) ..	23·69
Mucilage, sugar, and digestible fibre	30·13
Woody fibre (cellulose)	7·91
† Mineral matter (ash)	16·13
	100·00
* Containing nitrogen	3·79
† Including sand	10·04

"An impure cake, containing 10 per cent. of sand, as well as foreign starchy bodies. Its quality is poor. "J. AUGUSTUS VOELCKER."

On making inquiry about the first and third samples, Dr. Voelcker was informed that they were both samples of one lot of three tons purchased on November 17th, at 8*l*. 15*s*. per ton delivered, less 5*s*. per ton cash, which formed part of a contract for seventy tons of pure linseed-cake, to be delivered at intervals as required, to the end of April, 1887, each delivery to stand as a separate contract. The vendors were the manufacturers, Messrs. Pearson Bros., Baltic Mills, Gainsborough, the three tons being invoiced as pure linseed-cake.

Previous to this, Mr. Foljambe's bailiff had had a sample analysed, also Pearson's cake, which Dr. Voelcker reported on as being "a pure cake, not rich in oil."

The following letters were received:—

"C. W. Lister Kaye, Esq., "Baltic Oil Mills, Gainsborough,
"Osberton Grange. "December 9th, 1886.

"DEAR SIR,—We thank you for your letter this morning. With regard to the analysis we are positively astounded, and do not for one moment believe Dr. Voelcker's report to be an accurate one. It is simply impossible for the cakes sent to you to contain that amount of sand; they were made from the same seed and at the same time as the ones from which Mr. Blair sent a sample, and the analysis should come out the same; also the last 3 tons sent you were of the same kind. Will you kindly compare this analysis with the one obtained by Mr. Blair? There is a mistake somewhere, and we have to-day sent samples of the cakes Mr. Wray took from your farm to another analyst in London, and hope to have his report thereon in a few days. Mr. Pearson is in London on business, and we have informed him of your letter, and he will call upon Dr. Voelcker. Also we send him a sample of cake, same as last sent to you, of which we have about a ton or more left. Hoping to give you further particulars in a short time.—Yours faithfully,

"PEARSON BROTHERS, W.P."

"P.S.—5.30 p.m. Mr. Pearson wires us that he will call on Dr. Voelcker this afternoon, failing his being at home in the morning."

"C. W. Lister Kaye, Esq., "Baltic Oil Mills, Gainsborough,
"Osberton Grange. "December 15th, 1886.

"DEAR SIR,—We beg to enclose you copy of analyses of the three samples of cakes. Nos. 1 and 2 are part of the samples Mr. Wray brought from you,

and No. 3 is a sample taken from the bulk of the last three tons sent to you, We are quite certain that Dr. Voelcker has made some error, and no doubt that in his report on another sample (a duplicate of these) our impressions will be fully confirmed, as it is really a matter of impossibility for the cakes sent to contain anything like the quantity of sand he alleges, and we think these analyses will be found similar to the one made for Mr. Blair.

"Trusting we shall yet be able to convince you that it has at all times been our wish to supply you with a good quality of pure cake. Esteeming your further commands.—Yours faithfully, "PEARSON BROTHERS, W.P."

"COPY OF ANALYSES BY A. SIBSON, F.C.S.

"December 13th, 1886.

	No. 1.	No. 2.	No. 3.
Moisture	9·80	11·24	9·80
Oil	9·46	8·46	9·20
*Albuminous compounds	23·75	26·15	25·62
Mucilage and other carbonaceous principles	39·36	41·08	41·13
Phosphates	5·13	4·80	4·86
Fibre	8·37	7·63	8·76
Insoluble matters	4·13	0·64	0·63
	100·00	100·00	100·00
* Containing nitrogen	3·80	4·20	4·10

"ALFRED SIBSON, F.C.S."

In consequence of this correspondence, Dr. Voelcker has seen the manufacturer and convinced him of the impurity and inferiority of the cakes which were sent by Mr. Lister Kaye, and of the correctness of his report.

ADDITIONS TO THE LIBRARY IN 1886.

I.—PERIODICALS PRESENTED TO THE SOCIETY'S LIBRARY.

Presented by the respective Societies and Editors.

A.—ENGLISH, AMERICAN, AND COLONIAL PERIODICALS.

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EMLYN, Viscount.
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LITTLE, H. J.
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WHITEHEAD, CHARLES.

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GRENVILLE, R. NEVILLE.
HOWARD, C.
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PELL, A.
VOELCKER, Dr.
WAKEFIELD, W. H.
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SUTTON, MARTIN J.

Veterinary Committee.

THOROLD, Sir J. H., Bt. (Chairman).
BRIDPORT, General Viscount.
EGERTON OF TATTON, Lord.
MORETON, Lord.
COKE, Hon. E. K. W
PARKER, Hon. C. T.
RIDLEY, Sir M. WHITE, Bt
ALLENDER, G. M.
ASHWORTH, A.
BROWN, Professor.
CLAY, C.
COPE, A. C.
DENT, J. D.
FLEMING, GEORGE.
FOSTER, S. P.
HARPLEY, M. J.
KINGSCOTE, Colonel.
LLOYD, A. P.
ROBERTSON, Professor.
PELL, A.
SANDAY, G. H.
SIMONDS, Professor.
SMITH, A. J.
WAKEFIELD, W. H.
WILSON, JACOB.

Stock-Prizes Committee.

COVENTRY, Earl of.
EMLYN, Viscount.
MORETON, Lord.
COKE, Hon. E. K. W.
PARKER, Hon. C. T.
ALLENDER, G. M.
ARKWRIGHT, J. H.
ASHWORTH, A.
AYLMER, H.
BOWEN-JONES, J.
CHANDOS-POLE-GELL, H.
FOSTER, S. P.
FRANKISH, W.
GILBEY, WALTER.
GORRINGE, H.
HEMSLEY, J.
HOWARD, C.
MAINWARING, C. S.
MARTIN, J.
MILLER, T. H.
RANDELL, C.
SANDAY, G. H.
SCARTH, W. T.
SHERATON, W.
SIMONDS, Professor.
SMITH, A. J.
STRATTON, R.
WILSON, JACOB.
The Stewards of Live Stock.

Implement Committee.

HEMSLEY, J. (Chairman).
BRIDPORT, Gen. Viscount.
MORETON, Lord.
PARKER, Hon. C. T.
THOROLD, Sir J. H., Bt.
ALLENDER, G. M.
ANDERSON, W.
BOWEN-JONES, J.
CLAY, C.
FRANKISH, W.
GRENVILLE, R. NEVILLE
HOWARD, C.
HOWARD, J.
LITTLE, H. J.
MARTIN, J.
RANSOME, J. E.
SANDAY, G. H.
SHERATON, W.
STRATTON, R.
WILSON, JACOB.
The Stewards of Implements.

General Newcastle-on-Tyne Committee.

THE WHOLE COUNCIL, with the following representatives of the LOCAL COMMITTEE:—

BELL, T.
DODS, T. P.
FURNESS, H. M.
GRAY, T.
NEWCASTLE-ON-TYNE, MAYOR OF.
NEWCASTLE-ON-TYNE, TOWN CLERK OF.
STEPHENSON, CHRISTOPHER.
STEPHENSON, CLEMENT.
WALLACE, HENRY.

Show-Yard Contracts Committee.

RANDELL, CHARLES (Chairman).
ALLENDER, G. M.
ASHWORTH, A.
CLAY, CHARLES.
FRANKISH, W.
HEMSLEY, J.
HOWARD, C.
SANDAY, G. H.
WILSON, JACOB.

Committee of Selection.

CATHCART, Earl (Chairman).
COVENTRY, Earl of.
EMLYN, Viscount.
ASHWORTH, A.
FOSTER, S. P.
LITTLE, H. J.
PELL, A.

And the Chairmen of the Standing Committees.

Education Committee.

MORETON, Lord (Chairman).
EMLYN, Viscount.
THOROLD, Sir J. H., Bt.
BOWEN-JONES, J.
DENT, J. D.
FOSTER, S. P.
KINGSCOTE, Colonel.
LITTLE, H. J.
MAINWARING, C. S.
PELL, A.
RANSOME, J. E.
SUTTON, M. J.
VOELCKER, Dr.

Dairy Committee.

PARKER, Hon. C. T. (Chairman).
BRIDPORT, Gen. Viscount.
EMLYN, Viscount.
EGERTON OF TATTON, Lord.
THOROLD, Sir J. H., Bt.
ASHWORTH, A.
ALLENDER, G. M.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
GRENVILLE, R. NEVILLE.
MAINWARING, C. S.
SHERATON, W.

Cattle Plague Committee.

THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Thursday, December 9th, 1886.

REPORT OF THE COUNCIL.

The Council have to report that the list of Governors and Members have undergone the following changes during the present year: — 3 Governors and 476 Members have been elected; 2 Members have qualified as Governors; the deaths of 4 Governors and 159 Members have been reported, and 2 Governors have been transferred to the list of Members; 210 Members have resigned; and 30 Members have been removed from the list by order of the Council.

The Society now consists of:—

72 Life Governors,
64 Annual Governors,
3430 Life Members,
5697 Annual Members,
20 Honorary Members,

making a total of 9283, and showing an increase of 76 during the year 1886.

The death of Sir Edward Kerrison has deprived the Council of the services of one of the oldest Ex-Presidents and Vice-Presidents of the Society, and the vacancy has been filled by the election of Mr. Wakefield, of Sedgwick, Kendal, Westmoreland. The vacancy on the Council caused by the death of Mr. R. C. Ransome, which was reported at the last Annual Meeting, has been filled by the election of Mr. J. A. Smith, of Rendlesham,

Suffolk; and that resulting from the transfer of Sir M. W. Ridley to the list of Vice-Presidents by the election of Mr. Albert Pell, of Hazelbeach, Northampton. A further vacancy on the Council, owing to the resignation of Sir Hussey Vivian, Bart., has been filled by the election of Mr. J. E. Ransome, of Holme Wood, Ipswich; and that caused by the election of Mr. Wakefield as a Vice-President is still under consideration.

The auditors and accountants of the Society have examined and certified the half-yearly statement of accounts to the 30th June last, and it has been published in the 'Journal' for the information of the Members. The funded capital of the Society remains the same as at the last Annual Meeting in May, namely, 31,895*l.* 5*s.* 7*d.*, and the balance of the current account in the hands of the Society's bankers on the 1st instant was 1748*l.* 7*s.* 3*d.*

The opening day of the Norwich Meeting was marred by inclement weather, which effectually prevented many visitors from attending, and rendered the task of the Judges very uncomfortable. But this unfortunate commencement was more than retrieved by the remarkable attendances on the two last days of the Show. Their Royal Highnesses the President and the Princess of Wales, with the Princesses, showed their active interest in Agriculture by inspecting, during their visits, all the departments of the Show.

The hospitality of the County of Norfolk and the City of Norwich was worthily sustained by the Mayor and other residents of that City and neighbourhood. A pleasing feature of the Meeting was the official visit of a large number of Colonial and Indian representatives on the third day of the Show.

As an Exhibition of Live-Stock, the Norwich Meeting was far above the average, the total number of Entries having exceeded those of any year since the Kilburn Meeting in 1879. The distinguishing features were, as might have been expected, the large and excellent displays of Suffolk Horses, Hackneys, Red Polled Cattle, and Southdown Sheep.

The Council have decided to hold a Show of Thoroughbred Stallions at Newcastle-upon-Tyne, on January 25th. Five

equal Prizes, consisting each of 200*l.* and a special Gold Medal, will be offered for Thoroughbred Stallions (three years old and upwards), suitable for getting Hunters and other half-bred horses, subject to the condition and restriction that the prize-winners shall serve not less than fifty half-bred Mares, if required, during the season of 1887, and shall stand or travel (at the owner's option) in such parts of Northumberland, Durham, Cumberland, and Westmoreland, as are hereinafter specified, at a fee not exceeding fifty shillings to each Mare, except to Members of the Society, to whom the fee will be two pounds.

The districts are apportioned as follows :—

North Northumberland	District of Alnwick.
South Northumberland	District of Newcastle or Tyneside.
Durham	District of Durham.
Cumberland	District of Carlisle.
Westmoreland	District of Kendal.

A local Committee will be appointed in each of these districts, to whom all questions connected with the respective Stallions during the season of service may be referred.

The last day of Entry is Saturday, January 15th, 1887.

The Council have decided that the Newcastle Meeting shall commence on Monday, July 11th, and close on the following Friday evening, and that the Implement Yard only shall be open on the previous Friday and Saturday, July 8th and 9th.

In connection with the Newcastle Meeting the Council have decided to offer the following Prizes for Implements :—

	£
Class 1.—Portable Agricultural Engine, self-moving or otherwise, on the compound principle, not exceeding 8-horse power	200
Class 2.—Portable Agricultural Engine, self-moving or otherwise, on the simple principle, not exceeding 8-horse power	100
Class 3.—Weighing machine for sheep and pigs	20
Class 4.—Weighing machine for horses and cattle ..	25
Class 5.—Best machine for planting potatoes	25
Class 6.—Best machine for raising potatoes, the price to exceed 5*l.*	20
Class 7.—Best machine for raising potatoes, the price not to exceed 5*l.*	20
Class 8.—One-man power cream separator, the price not to exceed 20*l.* and capable of passing 20 gallons of milk per hour	25

The Council have decided to hold a competition for shoeing smiths in the Newcastle Showyard in three classes:—

CLASS 1.—Agricultural horses	6*l.*, 4*l.*, 3*l.*, 2*l.*, 1*l.*
CLASS 2.—Dray horses	6*l.*, 4*l.*, 3*l.*, 2*l.*, 1*l.*
CLASS 3.—Hunters and roadsters	6*l.*, 4*l.*, 3*l.*, 2*l.*, 1*l.*

The competition will be confined to the district of the Show, and no competitor will be allowed to enter in more than one class.

The Stock Prize-sheet for the Newcastle Meeting contains additional classes for Shire, Agricultural, and Clydesdale Horses, Hunters, Hackneys, and Ponies, including those used specially for pit purposes, as well as for Dairy Cattle, Border Leicester, Cheviot, Black-faced Mountain, Lonk, and Herdwick Sheep—all offered by the Local Committee; while the Society has added to its own usual list Prizes for Aberdeen-Angus, Galloway, Ayrshire, Highland, and Kerry Cattle; and, as usual, many Champion Prizes are offered by Herd-book and other Societies. The Prizes for Cheese are offered exclusively for those made in 1886, with the exception of the soft Cheeses, which must be of 1887 make. The Poultry Classes have been altered so as to include only a Cock and one Hen, instead of a Cock and three Hens as heretofore.

Prizes for the best-managed Farms in Northumberland and Durham have been offered by the Local Committee in five classes, and a Champion Prize of 100*l.* has been offered by the Newcastle Farmers' Club for the best Farm in the first four classes. Twenty-seven Farms have been entered for competition, and the Judges will commence their first inspection in the course of a few days.

An invitation from the authorities of Nottingham to hold the Show of 1888 in that locality having been received by the Council, a Committee of Inspection has been appointed to visit and report upon the sites, and other accommodation offered for the purpose.

A Committee has been appointed by the Council, to confer with other Societies, on the question of rates charged by Railway Companies for the conveyance of Breeding Animals during the season.

The Chemical Laboratory has been made use of by Members

to about the same extent as last year. The number of samples analysed has been 1581. The very decided fall in the price of all kinds of artificial manures, in particular sulphate of ammonia, as also in that of feeding-stuffs, has been a prominent feature of the year. While this has been to the advantage of the consumer, it has also had the effect of introducing a larger number of inferior articles than before, and the cases reported to the Chemical Committee show that the exercise by Members of their privileges of chemical analysis has been attended with great benefit.

The Field Experiments at Woburn have been carried on further, and during the winter two sets of feeding experiments were conducted—one on the value of ensilage for fattening bullocks, and the other on sheep-feeding. The results of these have been recorded in the last number of the 'Journal.' Fresh experiments have been commenced upon the growth of clovers, and also upon the laying down of grass to permanent pasture.

As announced in the last Report of the Council, arrangements have been made with the Royal Manchester, Liverpool, and North Lancashire Society, the Yorkshire Agricultural Society, the Essex Agricultural Society, and the Norfolk Chamber of Agriculture, for the carrying out of practical experiments in agriculture by a system of co-operation between these Societies and the Royal Agricultural Society. The experiments of the present year have been duly carried out, and visits of inspection have been made by officers of the Royal Agricultural Society. The several reports will in due course be presented to the Special Experiments Committee. The assistance of the Society's Laboratory has been also frequently given in connection with these experiments of Local Societies.

The most important feature in connection with the Seeds and Plants Diseases Committee is the appearance of the Hessian fly in this country, and its identification by the Consulting Entomologist, who has fully described this insect, and suggested remedies and methods of prevention, in the Society's 'Journal.' The work of the Entomological Section has much increased during the year, and the applications to Miss Ormerod for information concerning injuries to crops and fruit caused by insects have

been very numerous, not only from the United Kingdom, but from all parts of the world.

With regard to the Botanical Section, the enquiries addressed to the Consulting Botanist, though important, have not been so numerous as in some previous years. The greater part of these were in reference to the quality of grass seeds for permanent pasture. It is most satisfactory to note that the general result shows that the improvement in these seeds reported last year has been maintained. The presence of ergot has been detected in several localities in which there has been abortion among cows.

At the request of the Council, Professor Robertson, Principal of the Royal Veterinary College, and one of his assistants, spent some weeks in the laboratory of M. Pasteur, in order to study his method of inoculation for certain diseases of animals of the farm. Upon their return the Council made a grant to enable Professor Robertson to carry out experiments with the virus of anthrax and quarter-ill, and he is now ready to carry out protective inoculation for quarter-ill in cattle or sheep upon a limited number of animals within a reasonable distance of London.

The Council have also made a grant to Professor Brown for further experiments on the lung-worm in cattle and sheep, in continuation of those which were carried on by the late Dr. Cobbold, and the results of which are published in the current number of the 'Journal.'

In both these cases a delay of several months was experienced in consequence of the difficulty of obtaining licenses under the provisions of the Vivisection Act.

Colonel Picton Tubervill's Annual Prize of 25*l.* was last year offered for the best Essay on the Agriculture of Pembrokeshire. There were seven competing essays, and the Judges awarded the Prize to Mr. William Barrow Wall, of Pembroke, highly commending the essay by Mr. William Richards, of Hasguard Hall, Little Haven, South Wales, and commending that by Mr. Joseph Darby, of Stoke Newington.

The examinations for the Society's Junior Scholarships were held at the several schools on November 9th and 10th. Forty-two candidates were entered from six schools, and there was one

unattached candidate. The result of the examination is that fifteen candidates obtained sufficient marks to qualify them for Scholarships. Of these the first ten in the following list, arranged in order of merit, will receive scholarships upon complying with the Society's regulations, and the remainder will receive certificates of merit:—

Portsmouth Grammar School	Fredk. William Russell.
Northampton Grammar School ..	Samuel Warren Price.
" " " ..	Lewis Henry Cooke.
Ashburton Grammar School	William Ellis.
Northampton Grammar School ..	Henry Thomas Bradford.
Surrey County School	John Ramsay Bishop.
Ashburton Grammar School	Robert Francis Rendell.
Unattached	J. P. G. Hill.
Dorset County School	Thomas Kirkwood Hackett.
Ashburton Grammar School	Arthur John Ellis.
Portsmouth Grammar School	Frank Ernest Rock.
Surrey County School	Charles Francis Greenwood.
" " "	Peter Green.
Bedford County School	George Prestidge.
" " "	Randal Smyth.

The striking feature of the examination was the small proportion of candidates who passed in Chemistry, and it is a noticeable fact that most of the scholarships have been won this year by pupils from grammar schools.

By order of the Council,

H. M. JENKINS,

Secretary.

Royal Agricultural Society of England.

1887.

DISTRIBUTION OF MEMBERS OF THE SOCIETY AND OF MEMBERS OF COUNCIL.

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
A.	Bedfordshire ..	120 ..	3	Duke of Bedford, K.G., V.P.; C. Howard; James Howard.
	Buckinghamshire	106		
	Cambridgeshire ..	157 ..	2	H. J. Little; J. Martin.
	Essex	217 ..	1	W. Gilbey.
	Hertfordshire ..	144 ..	1	Sir J. B. Lawes, V.P.
	Huntingdonshire ..	50 ..	1	W. Wells, T.
	Middlesex	421 ..	1	G. M. Allender.
	Norfolk	368 ..	3	H.R.H. the Prince of Wales, K.G., T.; Hugh Aylmer; Robert Leeds.
	Oxfordshire ..	142 ..	2	Earl of Jersey; J. Druce.
	Suffolk	257 ..	2	J. E. Ransome; A. J. Smith.
		—— 1982	— 16	
B.	Cumberland	177 ..	1	S. P. Foster.
	Durham	190 ..	2	Earl of Ravensworth, V.P.; W. T. Scarth.
	Northumberland ..	231 ..	2	Sir M. White Ridley, V.P.; Jacob Wilson.
	Westmoreland ..	69 ..	1	W. H. Wakefield, V.P.
		—— 667	— 6	
C.	Derbyshire	196 ..	2	Hon. E. K. Coke; H. Chandos-Pole-Gell.
	Leicestershire ..	91 ..	1	Duke of Rutland, T.
	Lincolnshire	258 ..	3	Sir J. H. Thorold; H. Chaplin; W. Frankish.
	Northamptonshire	129 ..	2	Earl Spencer, V.P.; A. Pell.
	Nottinghamshire ..	186 ..	1	J. Hemsley.
	Rutland	15 ..		
		—— 875	— 9	

DISTRIBUTION OF MEMBERS OF THE SOCIETY—*continued.*

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
D.	Berkshire	158	2	M. J. Sutton; P. E. Crutchley.
	Cornwall	166		
	Devonshire	109	2	Sir T. D. Acland, T.; Sir M. Lopes, V.P.
	Dorsetshire	69	1	Viscount Portman, T.
	Hampshire	196	3	Viscount Eversley, V.P.; Sir A. K. Macdonald, T.; J. A. Caird.
	Kent	389	3	R. Russell; C. Whitehead; C. F. De Laune.
	Somersetshire	161	2	Visct. Bridport, T.; R. Grenville Neville.
	Surrey	196	1	G. H. Sanday.
	Sussex	248	3	Duke of Richmond and Gordon, V.P.; H. Gorringe; R. A. Warren.
	Wiltshire	120	1	J. Rawlence.
		1812	18	
E.	Yorkshire	546	4	Earl Cathcart, V.P.; Earl of Feversham; C. Clay; J. D. Dent, T.
F.	Gloucestershire	213	2	Lord Moreton; Col. Kingscote, T.
	Herefordshire	138	1	J. H. Arkwright.
	Monmouthshire	34	1	R. Stratton.
	Shropshire	495	3	A. P. Lloyd; J. Bowen-Jones; W. Sheraton.
	Staffordshire	257	2	Earl of Lichfield, T.; Marquis of Stafford.
	Warwickshire	199	1	P. A. Muntz.
	Worcestershire	177	2	Earl of Coventry; C. Randell.
	South Wales	168	1	Viscount Emlyn.
		1681	13	
G.	Cheshire	284	3	Lord Egerton, T.; Hon. Cecil T. Parker; A. Ashworth.
	Lancashire	456	3	Duke of Devonshire, V.P.; Earl of Lathom, V.P.; T. H. Miller.
	North Wales	205	2	Earl of Powis, T.; C. S. Mainwaring.
		945	8	
Scotland		143		
Ireland		119		
Channel Islands		14		
Foreign Countries		126		
Honorary Members		19		
Members without addresses		136		
		557		

ROYAL AGRICULTURAL

Dr. HALF-YEARLY CASH ACCOUNT

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st July, 1886:—			
Bankers	711 3 0		
Secretary	101 8 1		
		812 11 1	
At Deposit		2,000 0 0	
			2,812 11 1
To Income:—			
Dividends on Stock		462 9 7	
Interest on Deposit		11 12 3	
Subscriptions:—			
Governor's Life Composition	50 0 0		
Governors' Annual	15 0 0		
Members' Life-Compositions	472 0 0		
Members' Annual	970 2 0		
		1,507 2 0	
Establishment:—		10 0 0	
Journal:—			
Sales	71 2 6		
Sale of Pamphlets	19 12 3		
Advertisements	136 13 6		
		227 8 3	
Chemical:—			
Laboratory Fees		192 10 9	
Education:—			
Sale of Insect Diagrams		4 1 11	
Farm Prize Competition:—			
Prizes given by Norwich Local Committee	360 0 0		
Entry Fees for 1877	46 0 0		
		406 0 0	
Sundries		1 1 10	
Preston Meeting		24 5 6	
Total Income		.. .. ..	2,846 12 1
To Norwich Meeting		.. .. ..	14,329 1 0
			£19,988 4 2

BALANCE-SHEET,

LIABILITIES.	£ s. d.	£ s. d.	£ s. d.
To Capital:—			
Surplus, June 30th, 1886		39,746 4 0	
Less Surplus of Expenditure over Income during Half-year, viz.:—			
Expenditure	4,780 6 1		
Income	2,846 12 1		
		1,933 14 0	
			37,812 10 0
Deduct half-year's interest and depreciation on Country Meeting Plant		.. .. ..	225 8 0
			37,587 2 0
To Norwich Meeting:— Less Excess of Expenditure over Receipts		.. .. ..	278 9 5
			£37,308 12 7

QUILTER, BALL, & CO., *Accountants.*

SOCIETY OF ENGLAND.

FROM 1ST JULY TO 31ST DECEMBER, 1886. CR.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	933 10 0		
House:—Rent, Taxes, Repairs, &c.	368 4 0		
Office:—Printing, Postage, Stationery, &c.	201 17 2		
		1,503 11 2	
Journal:—			
Printing and Stitching	758 16 4		
Printing Advertisements	65 10 6		
Postage and Delivery	235 0 0		
Literary Contributions	259 11 0		
Woodcuts	32 19 6		
Advertising	26 11 2		
		1,378 8 6	
Chemical:—			
Salaries	427 18 4		
Apparatus and Chemicals	38 3 3		
Printing, Advertising and Stationery	49 9 0		
Petty Payments	22 7 0		
Alterations to Laboratory and Furniture	108 2 0		
		645 19 7	
Veterinary		99 8 0	
Seeds and Plants Diseases:—			
Consulting Entomologist's Salary	50 0 0		
Consulting Botanist's Salary	50 0 0		
		100 0 0	
Education:—			
Printing and Advertising	24 9 4		
Scholarships	200 0 0		
Examiners	15 15 0		
		240 4 4	
Farm Prize Competition:—			
Prizes	385 0 0		
Judges	244 9 7		
Advertising	132 14 6		
On account of 1887	20 10 5		
		782 14 6	
Preston Meeting		30 0 0	
Total Expenditure			4,780 6 1
By Country Meeting Plant			30 12 10
By Norwich Meeting			13,946 1 5
By Newcastle Meeting			400 0 0
By Stallion Shows			53 16 2
			19,210 16 6
By Balance in hand, 31st December:—			
Bankers		720 11 2	
Secretary		56 16 6	
			777 7 8
			£19,988 4 2

31ST DECEMBER, 1886.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	777 7 8	
By New 3 per Cent. Stock 29,885*l.* 4*s.* 4*d.* cost *	29,177 17 1	
By Consols 2,010*l.* 1*s.* 3*d.* cost †	2,000 0 0	
By Books and Furniture in Society's House	1,451 17 6	
By Country Meeting Plant	2,779 18 11	
		36,187 1 2
At Debit of Newcastle Meeting	1,067 15 3	
" " Stallion Show	53 16 2	
		1,121 11 5
		£37,308 12 7

* *Value at* 101 = 30,184*l.* 1*s.* 4*d.*
† *Value at* 101½ = 2,040*l.* 4*s.* 3*d.*

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscriptions to 31st December, 1886, which at that date amounted to 1,920*l.*

Examined, audited, and found correct, this 14th day of March, 1887.

FRANCIS SHERBORN,
A. H. JOHNSON,
C. GAY ROBERTS,
} *Auditors on behalf of the Society.*

ROYAL AGRICULTURAL

Dr. — Yearly Cash Account,

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st Jan. 1886:—			
Bankers	. .	1,503 6 10	
Secretary	. .	53 9 2	
			1,556 16 0
To Income:—			
Dividends on Stock	. .	895 16 3	
Interest on Deposit Account	. .	11 12 3	
Subscriptions:—			
Governors' Life Composition	50 0 0		
Governors' Annual	270 0 0		
Members' Life-Compositions	1,086 0 0		
Members' Annual	5,191 15 0		
		6,597 15 0	
Establishment:—			
Rent, &c.	. .	220 0 0	
Journal:—			
Sales	139 16 8		
Advertisements	286 0 9		
Sale of Pamphlets	25 3 1		
		451 0 6	
Chemical:—			
Laboratory Fees	. .	367 14 0	
Education:—			
Sale of Insect Diagrams	. .	7 2 3	
Farm Prize Competition:—			
Prizes given by the Norwich Local Committee	360 0 0		
Entry Fees for 1887	46 0 0		
		406 0 0	
Sundries	. .	2 14 11	
Preston Meeting	. .	73 16 6	
Norwich Meeting	. .	21,444 16 0	
Total Income	. .	. .	30,478 7 8
			£32,035 3 8

SOCIETY OF ENGLAND.

FROM 1ST JANUARY TO 31ST DECEMBER, 1886. CR.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure :—			
Establishment:—			
Salaries, Wages, &c.	1,850 0 0		
House: Rent, Taxes, Repairs, &c.	782 3 9		
Office: Printing, Postage, Stationery, &c.	600 5 7		
		3,232 9 4	
Journal :—			
Printing and Stitching Journal	1,407 6 7		
Printing Advertisements	125 6 6		
Postage and Delivery	460 0 0		
Advertising	26 11 2		
Literary Contributions	427 1 0		
Wood Engravings and Electros	47 7 5		
Printing Pamphlets	10 12 0		
		2,504 4 8	
Chemical:—			
Salaries	766 2 4		
Apparatus and Chemicals	79 9 10		
Printing, Advertising, and Stationery	49 9 0		
Petty Payments	48 10 0		
Alterations to Laboratory and Furniture	108 2 0		
		1,051 13 2	
Veterinary :—			
Medals	2 5 0		
Professional Fees	8 3 0		
On Account of Investigations	94 0 0		
		104 8 0	
Seeds and Plants Diseases :—			
Consulting Entomologist's Salary	100 0 0		
Consulting Botanist's Salary	100 0 0		
		200 0 0	
Education :—			
Fees to Examiners	68 5 0		
Printing and Advertising	64 15 7		
Scholarships	200 0 0		
Prizes	55 0 0		
		388 0 7	
Farm Prize Competition:—			
Prizes	385 0 0		
Judges	244 9 7		
Advertising	132 14 6		
On account of 1887	20 10 5		
		782 14 6	
Sundries :—			
Silo Prizes	130 0 0		
Silo Judges (balance)	199 4 4		
Silo Medals	7 6 0		
Expenses of Inspection Committee	31 14 11		
Gratuity to Dairymaid	25 0 0		
		393 5 3	
Subscriptions (paid in error) returned	. .	3 2 0	
Preston Meeting	. .	55 0 0	
Norwich Meeting	. .	22,001 9 6	
Newcastle Meeting	. .	400 0 0	
Stallion Show	. .	53 16 2	
Total Expenditure	. .	. .	31,170 3 2
By Country Meeting Plant	. .	. .	87 12 16
By Balance in hand, 31st Dec. 1886 :—			
Bankers	. .	720 11 2	
Secretary	. .	56 16 6	
			777 7 8
			£32,035 3 8

Receipts.

	£	s.	d.
Subscription from Norwich	2,000	0	0
Admissions to Show Yard by Payment	6,811	14	3
Admissions by Season Tickets	149	15	6
Admissions to Stand at Horse Ring	519	11	6
Admissions to Dairy	20	8	0
Sale of Catalogues	380	7	0
Sale of Guides to Dairy, &c.	8	4	9
Entries in Implement Catalogue	310	0	0
Advertisements in Stock Catalogue	204	7	6
Implement Exhibitors' Payment for Shedding	3,727	18	6
Non-Members' Fees for Entry of Implements	162	0	0
Fees for Entry of Live-Stock, &c.	751	5	0
Fees for Horse Boxes and Stalls	374	0	0
Fees for Entry of Poultry	45	3	0
Premium for Supply of Refreshments	375	0	0
Premium for Cloak Rooms, Lavatories, &c.	60	0	0
Fines for Non-Exhibition of Live-Stock	190	0	0
Fines, &c., for Implements	10	0	0
Sales of Dairy Produce, &c.	60	15	9
	16,160	10	9
Balance	1,062	1	3
	£17,222	12	0

Expenditure.

	£ s. d.	£ s. d.
Show-Yard Works:—		
By Timber and Joinery	4,720 19 9	
„ Ironmongery, 124*l.* 1*s.* 10*d.*; Hurdles, 126*l.* 14*s.* 7*d.*	250 16 5	
„ Bricks, Lime and Cement	62 12 1	
„ Paints, Oils, Glass, &c.	44 15 6	
„ Canvas, Felt, Baize, &c.	1,412 14 1	
„ Railway Charges, 259*l.* 18*s.* 6*d.*; Horse Hire, 115*l.* 4*s.* 10*d.*	375 3 4	
„ Coals, 14*l.* 9*s.* 2*d.*; Insurance, 10*l.* 10*s.*	24 19 2	
„ Postage and Stationery	41 12 10	
„ Sundries	20 12 7	
„ Wages	1,901 1 8	
„ Superintendent of Works—Salary and Expenses	571 5 2	
„ Depreciation of Plant	459 3 10	
		9,885 16 5
Per Contra:—		
By Sale of Materials	2,711 14 6	
„ Work for Exhibitors and Purveyors	1,643 3 4	
		4,354 17 10
		5,530 18 7
Judges' Fees.—Implements, 60*l.*; Stock, 443*l.* 15*s.* 8*d.*; Poultry, 29*l.* 1*s.* 4*d.*; Cheese and Butter, 24*l.* 4*s.* 2*d.*		557 1 2
Inspectors' Fees.—Veterinary, 63*l.*; Shearing, 24*l.* 9*s.*; Veterinary Assistants, 21*l.* 7*s.* 10*d.*		108 16 10
Police.—Metropolitan		436 9 6
Clerks and Assistants:—Bankers', 30*l.* 8*s.*; Secretary's and Stewards', 92*l.* 18*s.*		123 6 0
Foremen and Assistant-Foremen		101 19 6
Yardmen, Grooms, Foddermen, 328*l.* 5*s.* 6*d.*; Mowing Yard, 10*l.* 19*s.*		339 4 6
Superintendent of Turnstiles, Money Changer, and Money Takers, 48*l.* 2*s.*; Doorkeepers, 51*l.* 1*s.*		99 3 0
Stewards' Hotel and Travelling Expenses, 301*l.* 7*s.* 8*d.*; Assistant-Stewards', 59*l.* 10*s.*		360 17 8
Lodgings for Assistant Stewards, Implement Judges, and other Officials		156 2 6
Official Luncheons, Refreshments and Allowances		209 18 7
Catalogues.—Implements, 291*l.* 4*s.* 8*d.*; Stock, 360*l.* 4*s.* 7*d.*; Poultry, 4*l.*; Awards, 54*l.* 0*s.* 6*d.*; Plan of Yard, 27*l.*; Guide to Dairy, 15*l.* 15*s.*; New Packing Cases, Carriage, &c., 18*l.* 12*s.* 7*d.*; Commission, &c., 32*l.* 13*s.*		803 10 4
Printing, 877*l.* 2*s.* 8*d.*; Advertising and Bill Posting, 725*l.* 12*s.* 1*d.*		1,602 14 9
Postage, Stationery, Telegrams, Carriage, &c.		208 6 9
Engineering.—Engineers, 115*l.* 2*s.* 2*d.*; Assistants and Labourers, 36*l.* 17*s.* 10*d.*; Insurance of Machinery, 7*l.* 9*s.* 3*d.*; Ironmongery and Sundries, 11*l.* 1*s.* 3*d.*		170 10 6
Dairy:—Milk and Cream, 114*l.* 17*s.* 3*d.*; Ice, 15*l.* 10*s.*; Dairymaids, 40*l.*; Soft Cheese-Maker, 29*l.* 8*s.*; Use of Utensils, 11*l.* 4*s.* 10*d.*, and Carriage, 3*l.* 6*s.* 10*d.*; Engine, 13*l.* 13*s.* 1*d.*; Coals, 1*l.* 8*s.* 6*d.*		229 8 6
Hay, 233*l.* 14*s.*; Straw, 357*l.* 4*s.*; Green Food, 185*l.* 3*s.* 9*d.*		776 1 9
Straw, &c., for Trials, 16*l.* 9*s.* 3*d.*; Fire Engines, 30*l.* 11*s.*; Waterworks Men, 4*l.* 1*s.*		51 1 5
Horse and Carriage Hire		173 9 2
Journeys previous to Show, 23*l.* 0*s.* 6*d.*; Secretary and Official Staff, 40*l.* 6*s.* 7*d.*		83 7 1
Hire of Furniture, 49*l.* 0*s.* 2*d.*; Hire of Plants, 36*l.*; Hire of Chairs, 24*l.* 12*s.*		109 12 2
Poultry:—Hire of Bottles, 2*l.* 9*s.* 3*d.*; Poultry Food, &c., 5*l.*		7 9 3
Jackets and Caps, &c., 9*l.* 15*s.* 10*d.*; Hats for Boys 5*l.* 5*s.*		15 0 10
Commissionaires, 31*l.* 11*s.*; Boy Messengers, 8*l.* 2*s.* 6*d.*		39 13 6
Veterinary Medicines, 5*l.* 9*s.* 4*d.*; Hire of Harmonium, 1*l.* 5*s.*; Ironmongery, 14*l.* 17*s.* 1*d.*; Telegraph Extension, 13*l.* 19*s.* 3*d.*; Tan, 3*l.*; Calico, 3*l.* 4*s.* 4*d.*		41 15 0
Soap, Towels, Combs, Crockeryware and Cutlery, Compensation, and Sundries		37 1 7
Bee Exhibition		40 0 0
Rosettes, 28*l.* 11*s.* 7*d.*; Medals, 9*l.*		37 11 7
Prizes: Stock, 4,370*l.* *; Cheese and Butter, 157*l.*; Cheese and Butter Workers, 10*l.*; Implements, 25*l.*; Poultry, 230*l.*		4,792 0 0
		£17,222 12 0

* Exclusive of 1050*l.* given by the Norwich Local Committee, the Suffolk Agricultural Association, the Mayor of Norwich (John Gurney, Esq.), Gurney Buxton, Esq., and H. Birkbeck, Esq.; 50*l.* by the Shorthorn Society; 30*l.* by the Hereford Herd Book Society; and 25*l.* by the Shire Horse Society.

AGRICULTURAL EDUCATION.

ELEMENTARY EXAMINATION OF PUPILS OF MIDDLE-CLASS AND OTHER SCHOOLS.

Examination Papers, 1886.

A. AGRICULTURE.

November 9th, 1886.

(*Three Hours Allowed.*)

N.B.—*Use the fewest possible words: Essays are not wanted.*

I.—THE SOIL

Is (*a*) a warehouse—(*b*) a laboratory—(*c*) a feeding machine.

1. What materials of use as plant food are stored in the soil as in a warehouse: and what are the necessary substances in which it is most often deficient; which must then be artificially provided?

2. What processes are naturally going on in the laboratory of the soil for the preparation of food for plants?

3. What can the farmer do (*a*) to replenish the warehouse of the soil—(*b*) to quicken or regulate the processes conducted in the laboratory of the soil—(*c*) to improve it as a machine for feeding plants?

4. How does land drainage affect the soil, (*a*) as a warehouse, (*b*) as a laboratory, (*c*) as a feeding machine.

II.—PLANT LIFE

Includes (*a*) the germination of the seed—(*b*) the growth and cultivation of the crop—(*c*) the ripening and harvesting of its fruit.

1. What are the conditions necessary to the germination of the seed: and how does the farmer provide them?

2. What are the principal requirements of the plant during the growth of the crop: and how does the cultivator provide them (*a*) in the case of the wheat crop, and (*b*) in the case of the turnip crop?

3. What are the last steps in the ripening process, (*a*) in the case of the wheat crop, and (*b*) in the case of the apple or the pear. In what respect or particular should this (*a*) affect or guide the practice of the farmer at harvest time: and are there any other crops in which (*b*) a corresponding ripening to that of the apple or pear takes place?

4. Enumerate and describe the various methods of harvesting of which the crops of English agriculture admit.

III.—THE LIVE STOCK OF THE FARM.

1. Enumerate the various products of animal life which are (*a*) saleable or (*b*) unsaleable on the farm.

2. State the various processes of waste (*a*) which food undergoes during the work of nutrition: those also (*b*) to which its several products are liable.

3. Enumerate and describe the various preservative or economising agencies which can be enlisted and directed to the diminution or avoidance of the several wastes to which food is thus liable—viz.: those (*a*) affecting the efficiency of food in the body, and those (*b*) which can be applied to the preservation of its several products.

B. ELEMENTARY CHEMISTRY.

November 9th, 1886.

(*Three Hours Allowed.*)

1. Describe briefly the general properties of oxygen. What class of compounds does it form with other elements, and how do these vary in their general characteristics? Are there any elements with which oxygen will not combine?

2. What are the principal differences between distilled water, rain-water, a soft river-water, a hard well-water, and sea-water? How do you suppose these differences arise?

3. What is meant by "water of crystallisation"? Give the formulæ of any three salts containing water of crystallisation.

4. If for the purpose of chemical analysis you wish to obtain a current of dry and pure air (oxygen and nitrogen), how could you get this?

5. Name the principal compounds which nitrogen forms with oxygen, assigning to each its formula. How would you test for a nitrate?

6. Describe briefly the manufacture of oil of vitriol of commerce.

7. In what forms is silver found in nature? Give any process by which the pure metal is obtained in quantity.

8. How would you distinguish between the sulphides of the following metals:—copper, mercury, lead, zinc, arsenic, iron?

9. What is white lead? Describe its preparation.

10. Define in chemical language, as nearly as you can, the following:—galvanised iron, brass, red lead, porcelain, spirits of hartshorn, bleaching-powder, *aqua regia*, soda crystals, sal-volatile, dolomite.

C. MECHANICS AND NATURAL PHILOSOPHY.

November 10*th*, 1886.

(*Three Hours Allowed.*)

1. Mention any one property of the centre of gravity of a body.

A triangular piece of card-board is of uniform density; where is its centre of gravity situated?

2. Draw an angle B A C of 120°, and draw a line A D such that B A D is an angle of 30° and C A D a right angle. A force of 200 units acts from A to D; find, by construction or otherwise, the components of the force along A B and C.

3. Why are the power and the weight equal in a single fixed pulley?

Show in a diagram a combination of one fixed and one movable pulley, employed to raise a weight; if the weight is 200 lbs., find the power required to lift it.

4. A cylinder of given dimensions stands upright on a plane which is gradually made to incline at a greater and greater angle to the horizon; the roughness is sufficient to prevent sliding; show in a diagram the slope of the plane when the cylinder is just about to topple over.

5. A body moves from rest in a straight line under the action of a constant force; in the first three seconds of its motion it passes over 18 feet; at the end of the first five seconds, what distance has it described and how fast is it moving?

6. Two bodies, whose weights are 10 lbs. and 12 lbs., are connected by a fine thread which rests on a smooth fixed point, so that one body hangs down on one side, and one on the other. If the bodies are allowed to move, what is the numerical value of the mass moved, what of the force producing the motion, and what of the velocity gained per second by each of the bodies?

7. Explain briefly the action of the common forcing pump.

If the area of the cross section of the plunger is 25 sq. in., and water has to be forced to a height of 50 ft. above the lower end of the plunger, what force must be applied to the plunger?

N.B.—You may take 28 cubic inches of water to weigh a pound.

8. Define the specific gravity of a solid or liquid.

A body weighs 400 grains *in vacuo;* its specific gravity is 8; how many grains will it weigh in water (sp. gr. 1), and how many in a liquid whose specific gravity is 0·9?

9. What does the height of the mercurial column of a barometer measure?

If the barometer becomes faulty in consequence of some air getting into the space above the mercury, what does the height of the column now measure?

10. Describe briefly the governor and throttle valve of a steam-engine, and their action. What is the use of these parts of the engine?

D. MENSURATION AND LAND SURVEYING.

November 10*th*, 1886.

(*Two Hours Allowed.*)

1. The area of a right-angled triangle is 10,000 sq. feet, its base is 250 ft. long; draw it to a scale of 50 ft. to the inch, and note the length of the hypotenuse, and the angles of the triangle.

2. The sides of a quadrilateral taken in order are A B = 1250 ft., B C = 1430 ft., C D = 1800 ft., and D A = 1140 ft., the diagonal B D = 1320 ft.; draw the figure to a scale of 400 ft. to an inch, and find its area; also note the angle B C D as measured by a protractor.

3. A square field has an area of 20 acres; find the length of one of its sides.

4. A cylindrical reservoir is 20 ft. high; the diameter of its base is 20 ft.; how many cubic feet of water can it contain, and, if made of iron plates, how many square feet of plate are there in the upright part, neglecting overlap.

5. Draw a scale of 60 ft. to the inch, of such a length and so divided that any distance from 5 ft. to 300 ft. can be measured on it. Draw a line to represent on the scale 135 ft.

6. A, B, C, D, are four points taken in order along a straight road; P, Q, R, points between A and B, B and C, C and D respectively; when a level is at P the readings of the staff are 8 ft. at A, 3·5 ft. at B; when at Q, the readings are 6·7 at B, 5·2 at C; when at R the readings are 4·1 at C, 6·3 at D; if A is 100 ft. above the datum line, what are the heights of B, C, and D? If the level had been kept at P, what would have been the readings of the staff at C and at D?

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W, Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, May 23rd, 1887, at 12 o'clock.

MEETING at Newcastle-upon-Tyne, July 11th to 15th, 1887.

GENERAL MEETING in London, December, 1887.

MONTHLY COUNCIL (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays, 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on pages xxix and xxx in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page xxvi).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (pages xxxi and xxxii).

SUBSCRIPTIONS.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker's or any other house of business in London will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the postmaster the correct initials and surname of the Secretary of the Society, otherwise the payment will be refused to him at the post-office on which such order has been obtained; and when remitting the money-orders it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be drawn on a London (not on a local country) banker. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper party. No coin can be remitted by post unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary.

*** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

The Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *bonâ fide* and sole use of Members of the Society. Members have also the privilege of sending samples for Analysis on behalf of any Farming Company of which they may be directors or managers, provided that the substances so sent shall be for use on the farm of the Company and not for sale to other persons. Members of the Society are also allowed to send to the Society's Laboratory for analysis, at the same scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants, or which they propose to give free of cost to their occupying tenants. To avoid all unnecessary correspondence, Members are particularly requested, when applying to the Consulting Chemist, to mention the kind of analysis they require, and to quote its number in the subjoined schedule.

The charge for analysis, together with the cost of the carriage of the specimens (if any), must be paid to the Consulting Chemist at the time of application.

No.		
1.—	An opinion of the genuineness of bone-dust or oil-cake (each sample)	2*s.* 6*d.*
2.—	An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda	5*s.*
3.—	An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
4.—	An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	5*s.*
5.—	An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
6.—	An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it	10*s.*
7.—	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
8.—	An analysis of limestone, showing the proportion of lime and magnesia	10*s.*
9.—	An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay	10*s.*
10.—	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.—	Complete analysis of a soil	£3
12.—	An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties	10*s.*
13.—	Analysis of any vegetable product	10*s.*
14.—	Analysis of animal products, refuse substances used for manures, &c. ..	from 10*s.* to £1
15.—	Determination of the "hardness" of a sample of water before and after boiling ..	5*s.*
16.—	Analysis of water of land-drainage, and of water used for irrigation	£1
17.—	Analysis of water used for domestic purposes	£1 10*s.*
18.—	Determination of nitric acid in a sample of water	10*s.*
19.—	Examination of Viscera for Metallic poison	£2 2*s.*
20.—	Examination of Viscera complete, for metals and alkaloids	£5 5*s.*
21.—	Personal consultation with the Consulting Chemist. (The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment, it is suggested that Members desiring to hold a consultation with the Consulting Chemist should write to make an appointment)	5*s.*
22.—	Consultation by letter	5*s.*
23.—	Consultation necessitating the writing of three or more letters	10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. Augustus Voelcker, requests that all letters and parcels (postage and carriage paid) from Members of the Society, who are entitled to avail themselves of the foregoing Privileges, should be directed.

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

Feeding Cakes.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.

2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.

3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

Artificial Manures.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain not less than 45 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.

2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain not less than 48 per cent. of tribasic phosphate of lime, and to yield not less than 1¾ per cent. of ammonia.

3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed, under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.

4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.

5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.

6. *Nitrate of Soda* should be guaranteed by the vendor to contain from 94 to 95 per cent. of pure nitrate.

7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 23 per cent. of ammonia.

8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12, HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples not exceeding 12 oz., for four postage stamps.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12, HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials. No parcel sent by post must exceed 12 oz. in weight, 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcels-post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory, specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any Member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a visiting Inspector will be 2*l.* 2*s.* each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in cases of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the results of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector	10*s.* 6*d.*
Consultation by letter	10*s.* 6*d.*
Post-mortem examination, and report thereon	21*s.*

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs, 3*s.* 6*d.* per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan	Not yet appointed.
Carmarthen	ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester..	W. Lewis, 1, South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.

County.	*Name and Address.*
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset...	W. Vessey, Weymouth.
Durham	H. Peele, Tower Street, West Hartlepool.
Essex	James Taylor, Vengewell Hall, Wix Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Professor Nicholson Almond, Royal Agricultural College, [Cirencester.
Hants	J. D. Barford, 57, Above Bar, Southampton.
Hereford	W. Good, 30, Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	W. Bromley, Lancaster.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)..	Charles Hartley, 4, Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1, Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	Calver and Smith, Downham Market.
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmoreland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	C. Gresswell, Albert Square, Derby Road, Nottingham.
Oxford	Chas. N. Page, Banbury.
Pembroke	D. E. James, Bridge House, Haverfordwest.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	Mr. J. Worsley, Ipswich.
Surrey	J. I. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	J. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28, Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz.:—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical Privileges.

The Council have fixed the following rates of charge for the examination, by the Society's Consulting Botanist, of Plants and Seeds, for the *bonâ fide* and individual information and benefit of Members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

No.		
1.—	A report on the purity, amount, and nature of foreign materials, the perfectness, and germinating power of a sample of seed ..	5*s.*
2.—	Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention	5*s.*
3.—	Report on any disease affecting farm crops	5*s.*
4.—	Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value	10*s.*

N.B.—The Consulting Botanist's Reports are furnished to enable Members,—purchasers of seeds and corn for agricultural or horticultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes.

PURCHASE OF SEEDS.

The purchaser should obtain from the vendor, by invoice or otherwise, a proper designation of the seed he buys, with a guarantee that it contains not more than a specified amount of other seeds, and is free from ergot, or, in the case of clovers, from dodder, and of the percentage of seeds that will germinate.

The germination of cereals, green crops, clovers, and timothy grass should be not less than 90 per cent.; of fox-tail, not less than 60 per cent.; of other grasses not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

I. Seeds.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser and not from the purchase sample, and when bought by sample the whole or part of that sample should be sent.

When it is considered necessary to secure legal evidence, the sample should be taken from the bulk and placed in a sealed bag in the presence of a reliable witness, who is acquainted with the identity of the bulk, and care should be taken that the purchased sample and bulk be not tampered with after delivery, or mixed or come in contact with any other sample or stock.

One ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which each sample has been bought should be sent with it.

Grass-seeds should be sent at least FOUR WEEKS, *and clover-seeds* TWO WEEKS *before they are required, and they should not be sown until the report has been received.*

II. Plants.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S., 44, Central Hill, Norwood, London, S.E.

Members' Entomological Privileges.

The Council have fixed the charge of 2*s.* 6*d.* for the determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm-crops, with a report on its habits, and suggestions as to the methods of prevention and remedy.

INSTRUCTIONS FOR SENDING SPECIMENS.

Portions of the plants injured should accompany the specimens of the insects.

All specimens should be sent in tin or wooden boxes, or in quills, so as to prevent injury in transmission.

Parcels or letters containing specimens (carriage or postage paid) must be addressed to Miss Ormerod, F.R.Met.Soc., Dunster Lodge, Spring Grove, Isleworth.

THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.

VOLUME THE TWENTY-THIRD.

PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1887.

THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET AND CHARING CROSS.

CONTENTS OF VOLUME XXIII.

Second Series.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume;* the first volume belonging to 1839–40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

ERRATA.

In the Report "On Experiments conducted in 1886 by Local Agricultural Societies" in the last issue of the 'Journal' (Vol. XXIII. s.s., Part I., 1887), the following corrections should be made on line 9 from the bottom of page 268 [the Chloride of Sodium having been stated at ten times the correct amount]:—

For Chloride of Sodium	0·94	1·03	1·08
read " "	0·094	0·103	0·108
And for Organic matter and loss	7·36	3·70	2·46
read " " ..	9·206	4·627	3·432

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

XV.—*The Making of the Land in England: a Retrospect.* By ALBERT PELL, of Hazelbeach, Northamptonshire.

It is a common observation that the earth belongs to the race. The possession of land is thus regarded as a boon, the title to which is of a nature entirely different from that upon which the ownership of other property depends.

Raw land is, however, only a chance to prosecute the struggle for existence, and those who try to earn a living by the subjugation of raw land, find that they make the attempt under most unfavourable conditions, for land can be "made" or brought into use only by great hardship and exertion.

Men are too frequently blind to the difference between land in a state of nature and as they now find it presented to their eyes in an old and settled country such as ours, and so lose sight of the fact that the real boon or gift which so many covet is to get some land, after somebody else had made it fit for use. In the absence of information, the hardship and exertions of those who, for all historical time, have been making the land are ignored, the result unappreciated, and vague notions of appropriation justified, by referring the present value of land to what is termed its "unearned increment."

The difference, however, between man in the prehistoric age and man in the Victorian age is not more marked than that between the condition of the land in the former and in the later period; nor are the struggle and the sacrifice, through many ages, undergone in the civilization of the one, any more real than those involved in the reformation and improvement of the other.

The present moment, with the rent of agricultural land in England declining under the competition of America and India, is not well chosen for attacking the supposed advantage

landowners enjoy: rather it seems a most suitable season for inquiry, not of a political but of a practical kind, into the causes of the modern value, so as to ascertain whether or no it really depends upon the extraneous influence of the surrounding capital and labour of an industrious and populous society. No doubt such an influence is in operation, and has in some instances an appreciable effect; but the case of the landowner and agriculturist is, that in purely rural districts this modern value can be directly traced to the expenditure for years of energy and money on the subject-matter itself by its owners, the capital sum of which when taken into account may possibly be found to exceed the market-value of the estates on which it has been expended.

This view of the case is put forth and supported by a distinguished American writer,* who seems to have anticipated, in the assertion of this claim on behalf of the State, a serious check to the employment of private labour and capital in the subjugation of the prairie and the forest by those whose title to such land is based on a patent from the Federal Government, coupled with industrial occupation.

We in England are at the present day but the heirs or successors to others, who, whether they derived their original title in the wilderness and waste by patent, grant, conquest, diplomacy, or communal inheritance, generally got nothing, apart from wild animals and minerals, for the expenditure of toil and capital in the development of their acquisition but the chance of remuneration. Any one who will look, for instance, into the history of the "making of the land" in the great level of the fens in the time of the Stuarts, will learn that the chance of remuneration was then anything but a good one for the adventurers and pioneers on those great and useful works.

Some of us have been eye-witnesses of the nature and extent of the warfare of human industry against natural obstacles in the New World, of which Great Britain in recent years has furnished only occasional examples. Possibly ninety-nine out of every hundred of the present inhabitants of England can form no conception of the character and severity of this struggle, and it may not be out of place to reproduce a picture of it as drawn by De Tocqueville from personal observation. He says:—

"The bells round the necks of the cattle announced our approach to a 'clearing' when we were yet a long way off, and we soon afterwards heard the stroke of the hatchet hewing down the trees of the forest. As we came nearer, traces of destruction marked the presence of civilised man; the road

* Professor Sumner of Yale College.

was strewn with shattered boughs; trunks of trees half-consumed by fire, or cleft by the wedge, were still standing in the track we were following. Beyond a field, at present imperfectly traced out, we suddenly came upon the cabin of its owner, situated in the centre of a plot of ground more carefully cultivated than the rest, but where man was still waging unequal warfare with the forest; there the trees were cut down, but their roots were not removed, and the trunks still encumbered the ground they had so recently shaded. The master of the dwelling belongs to that restless, calculating, and adventurous race of men who do with the utmost coolness things only to be accounted for by the ardour of the passions, and who endure the life of savages for a time in order to conquer and civilise the backwoods. By the side of the hearth sits a woman with a baby on her lap; her delicate limbs appear shrunken, her features are drawn in, her children are the true children of the wilderness, full of turbulence and energy. She watches them from time to time with mingled melancholy and joy. To look at their strength and her languor, one might imagine that the life she has given them has exhausted her own, and still she regrets not what they have cost her. In the one chamber of which the house consists the whole family is gathered for the night. The dwelling itself is a little world—an ark of civilisation amid an ocean of foliage; a hundred steps beyond it the primeval forest spreads its shades, and solitude resumes its sway."*

Our English ancestors have undergone at home the same toil and privations in their conflicts with Nature. The wolf had to be extirpated before the flock could be safely established; the forest had to be cleared before the open field could be set out; the great river to be embanked before the flood could be restrained, and the fen made only summer land. This, however, was but a first approach towards cultivation.

The communal occupation of this virgin soil soon came under the necessity of regulation and order, to become of any real service to an advancing and growing population not content to remain savages. The commonable lands had to be set out in strips with owners' rights, not yet indeed complete, but sufficiently appropriated to allow of some private enterprise in the growth of grain. The manor-house, the church, and the homesteads appeared on the scene, shelter for cattle was provided in winter, and the breeds improved. With buildings and arable husbandry and winter shelter, came the need for bridges, ferries, roads passable in summer; unserviceable, indeed, in winter, but, such as they were, constructed and maintained solely by those who had subjugated and brought into cultivation the soil over which they passed.

People now living may have seen decaying under the walls of a parish church the enormous wooden plough, girt and stayed with iron, which, as spring approached, was annually furbished up and brought into the village street. For this the owners or their tenants, acting in concert, made up joint teams

* De Tocqueville's 'History of Democracy in America.'

of six or eight powerful horses, and proceeded to the restoration of their highways, by ploughing them up, casting the furrows towards the centre, and then harrowing them down to a fairly level surface for the summer traffic. They have lived to see the same highways first and for years mended with weak and rotten sand and gravel, and finally hardened and rendered water-proof with granite, transported 50 miles or more for that purpose.

Progress, however, was stayed by the exercise of the remaining communal rights, and a further step was taken by the owners to allot among themselves in severalty that which hitherto they had enjoyed in common, and to free their cultivated lands from the customary right exercised by sheep-masters and the owners of commonable cattle and animals, as well as the otherwise incurable evil of a prescriptive course of cropping which rendered the provision of sufficient winter food an impossibility. At an enormous expense this last great step towards efficient tillage and grazing was carried out with the sanction of Parliament, and the way was clear for the erection of suitable homesteads, no longer huddled in the villages, but placed in the newly set out freeholds, and for the complete removal of the superfluous water by open ditches and under-drains. The English landowner was not slow to make use of the opportunity now given for laying the soil dry, and for sheltering and subdividing his cattle by enclosures fenced off by hedges or stone walls, and the cost value of the made land of the empire was speedily raised by the enormous expenditure on these works.

There are other subsidiary and local improvements that must not be overlooked, such as warping, claying, marling, pumping from low levels, all of which operations have necessitated an outlay of capital, and a periodical charge for renewal, without which the soil would be entirely unfitted for modern husbandry. There is, it may be broadly asserted, but a small portion of rural England the present value of which is not due wholly or in a very large part to the costly operations to which reference has been made, and which have been conducted wholly at the charge of the successive owners of the soil.

In the twenty-fourth volume of the First Series of this Journal, Mr. Belcher has drawn a remarkably clear picture of what remains to be done after the forest trees of wild land have been removed. Speaking of Wychwood Forest, then recently grubbed up, he says:—

"The land, when given into the hands of the tenants, presented anything but a smooth inviting appearance. Wide ditches, and long irregular high banks that had formed the boundaries of the different coppices; deep pits and hollows, where stones had been dug for the use of bygone generations; small straggling briars that had escaped the notice of the wood-grubbers; roots of

trees and underwood left a few inches below the surface; large patches of rough brown fern stems that had afforded cover to the fawns;—all these and many other impediments stood in the way of the 'forest farmers,' and made 'speed the plough' an earnest desire with the ploughmen, but seldom realised; for it was with the greatest difficulty that four strong horses drawing a large iron plough could break up half an acre a-day, and many and long were the blacksmiths' bills for repairs to the tackle where the plough was used in breaking up the soil. Some of the tenants tried digging at a cost of 3*l.* per acre; some used stocking hoes and grubbed the ground 5 inches deep, carefully picking out the large stones that were beneath the surface: this plan cost 50*s.* per acre."

These operations, however, laborious and costly as they proved to be, left the land but poorly prepared and wholly unfurnished for farming operations, unless the surface had been there and then sown down in one prairie to grass, for which it would have even then required some such previous operation as breast-ploughing, at the cost of about 23*s.* an acre. For the growth of grass and winter food, for local traffic, for the shelter of man and beast, the owner had further to provide roads fenced in with boundary-walls, or quick-fencing taking five years at the least of careful nursing and effectual protection to rear and establish.

Farmhouses, cottages, wash-pits, cattle-pens, waterings, plantations and gardens had further to be provided. The highways would come to 700*l.* per mile, the occupation roads to about half that sum. The two boundary-walls would come to 200*l.* per mile, or, if the fencing was done with quick, to a little larger sum. At least that was the case in the reclamation of Wychwood Forest. There still remained the first thorough draining of the new fields to be executed, at a cost to the owner of from five to seven pounds an acre.

There is no operation brought into this statement which it has not been incumbent on the owner to execute on the soils of England in general cultivation. The chalk downs stand in a category by themselves, to which these remarks would not apply. The sands and gravels would not require under-draining, but their texture would on the other hand require strengthening and cooling by the expensive process of marling or chalking.

Wychwood Forest, as we have seen, furnishes an instance of the subjugation of wild land and its conversion to a condition fit for all the purposes of modern husbandry within the present generation. Processes which have been slowly worked out during centuries were here undertaken and completed in almost as many years. The English flora and fauna in all their natural fitness and beauty were violently and ruthlessly destroyed to make way for artificial grasses and cereals, the

imported root-crops, and the less graceful forms of domesticated farm stock. The transformation, though costly, was complex and complete.

We will pass from the centre of England to the north, to a tract of high land, the home of the grouse and wild-fowl at all seasons, and the outrun during summer for some hardy hill stock. The soil itself, not sour or sterile, invited the hand of a generous and wealthy improver; the climate indeed suggested caution, but even that hope held out might be ameliorated, if the ever-present cold wet in the soil could be removed, and the driving blasts and storms be broken by stone fences and shelters. Though the growth of grain and crops in rotations was admittedly out of the question, the more moderate and simpler enterprise of improving the permanent pasture by the removal of the heather, by liming and draining, seemed to offer a fair prospect of return for the outlay.

The moor in question contained 5750 acres, for the most covered with heather, and before the improvement was excellent grouse ground. The portion improved was originally the best part of the moor, and comprises 656 acres. The reclamation was carried out about thirty years ago, and at that time the rent of the whole moor was 200*l.* a-year, or 8*d.* per acre all over; while the value of the better portion selected for reclamation might be taken to have been 1*s.* an acre. The undertaking, which extended over a period of fourteen years, consisted in draining, liming, stone-fencing, building cattle-sheds for shelter, and water-weiring, that is, protecting the banks of streams by stones or wattling:—

	£	*s.*	*d.*
The draining cost	5,587	4	0
Liming	8,255	16	4
Fencing	616	7	5
Water-weiring	224	2	2
Cattle-sheds	517	4	1
Sundries	790	0	3
Total	£15,990	14	3

From the above it appears that these simple operations cost no less than 24*l.* 7*s.* 6*d.* per acre. There was nothing unusual or fanciful in their character; they consisted solely in removing the superabundant water from the soil by draining, in keeping the torrents within bounds, in sweetening and improving the pasture by lime, in enclosing with walls built of stone found on the spot, and in erecting shelter for the animals brought on to graze. Thousands of other acres have been thus reclaimed from time to time. For some years the whole moor was kept in

hand, and grazed with cattle and sheep, and in 1867 it was let as a farm at the annual rent of 800*l.* In 1874 on a revaluation, this rent was increased to 824*l.*, the improved land being then valued at 6*s.* 8*d.* per acre. The result of the operations, therefore, financially, is an expenditure of 24*l.* 7*s.* 6*d.* an acre (more than half of which was for liming, the effect of which cannot be regarded as permanent), and an increased rental of 5*s.* 8*d.* an acre, or a little over one per cent. on the capital employed. There can be no grounds in this case for assuming that the owner has been benefited by any "natural increment of value." On the contrary, the case furnishes a very striking and useful proof of the need of caution and moderation on the part of those who might be inclined to fasten on owners a legal obligation to bring waste lands and grouse moors into cultivation.

To complete the history of this improvement, it must be added that whilst the land when covered with heather was a splendid piece of grouse moor which would now have commanded a game rent of 2*s.* 6*d.* per acre, it has been rendered valueless for that purpose: so that deducting, as is proper, this sum from the improved rent of 5*s.* 8*d.*, we arrive at a nett financial gain of 3*s.* 2*d.* per acre, or a return of about 13*s.* per annum on an expenditure of 100*l.* If either by the unflagging zeal of the owner or, as is sometimes suggested, under State compulsion, the improved condition of the land is to be preserved, the liming, the effects of which are gradually wearing out, will have to be renewed at a cost which, with present prices of produce, hardly promises to be remunerative.

Another instance of reclamation of waste land in a northern county of England may be worth mentioning. The common comprised about 4000 acres, one half of which was enclosed about six years ago, under the authority of Parliament. The proprietor of an estate in the manor, who was favourable to this enclosure, received in respect of such estate an allotment of 113 acres of cold moorland, growing rushes and coarse grass. At a cost of 400*l.* this was fenced and open-drained, and the enclosure expenses discharged. The largest offer to rent this allotment has been 12*l.* Probably at the present time it would not command 10*l.* And as the common right prior to the enclosure was worth about 5*l.*, the resulting nett gain from this improvement or subjugation of the waste has been 5*l.* per annum, or $1\frac{1}{4}$ per cent. on the capital applied.

It will be proper next to examine into the extent and cost of those secondary operations which a survey of the general features of the country informs us must have followed its recovery from a state of nature, and to estimate the approximate cost per acre of

such operations. For this purpose examination has been made, with the aid of the 6-inch Ordnance Map, into their nature and extent in a selected parish. The one in question is in the Midland counties, remote from any considerable town, has a population less than 150, and probably never has had one of more than 200. It was enclosed in the reign of Elizabeth, being at that time for the most part open unenclosed commonable fields of arable and lammas land, some brakes of thorns and gorse, with a few old enclosures, probably not above 50 acres in extent, around the messuages, tofts and church. The area was, and is, 1648 acres. The surface soil is of a most varied character, some heavy clay, a small amount of gravel, more loam, and a considerable tract of red oolitic iron formation. It is extremely undulating and has been full of dangerous bogs and springs, the drainage of which has been difficult and costly, but not more so than has been the case in the surrounding parishes. To draw off the spring water many of these drains have been cut to the depth of 15 and 20 feet.

The snipe, the dotterel and woodcock, which up to the beginning of the century were common, are now hardly ever seen. As late as 1808, private diaries show that the squire of the place spent many a night with his draw-nets and setters in taking these birds, as well as other winged and ground game, the remains of a practice that no doubt was common enough before the days of enclosure. The badger, the fox, the foumart and mole were all placed in the same category of destructive vermin, and the hand of man was raised without any discrimination against them. The visiting of neighbours at any distance was suspended from October to April, and the coal, which was fetched from a considerable distance, was laid down before Michaelmas. The ways and roads were then broken up by the weather and were abandoned as unfit, alike for light vehicles and heavy-draught waggons.

The surveyor's map of the Elizabethan deed shows that the proprietors divided their new allotments into eighteen large enclosures, to which were added sixteen small crofts adjoining the thirty houses of the inhabitants, whose census came probably to about one hundred and fifty souls. Forty years ago there was no hard road to the adjoining village on the south, and even now the hard road to that on the north is in places not even commenced.

The parish has ultimately been subdivided into 150 fields, now traversed by over three miles of substantial public carriage ways, with the addition of about one mile of occupation roads, giving access from the former to the properties of several owners. The public ways were set out in the Elizabethan

deed 60 feet wide; they are now reduced to 30. At this width they appropriate 33 acres of land over which the public enjoys rights of free passage, insisting at the same time on the maintenance of a hard level weather-proof track of ample width, made, preserved, and protected solely at the cost of the proprietors of the land through which they pass. The cattle of the owners of the soil are prohibited from grazing its sides, and the very hedges and trees, which might and which have afforded them shelter, have to be reduced to statutable dimensions for the convenience and enjoyment of the casual wayfarer. These desirable results, attracting so little remark, regarded as they are as matters of course, and almost the production of Nature, have been effected only at a heavy charge on the real estate of the parish. Fifteen acres at the least are entirely lost in the metalled surface of the highways, and the account for the whole of the secondary works of reclamation will stand approximately as follows:—

	£
$3\frac{1}{6}$ miles of parish roads, at £700 per mile to make ..	2,216
The two boundary fences on either side, at £200 per mile	633
The one mile of occupation road and its fences	550
36 miles of quick fences to the 150 enclosures, at £112 per mile	4,032
200 gates and gateways to the enclosures, at 40*s*. ..	400
1600 acres drained at £6 6*s*. per acre, say	10,000
Total	£17,831

But the record cannot be closed here. Roads without bridges, carriageways without footpaths and causeways, grazing grounds without waterings, lairs or cattle-pens, would be regarded as incomplete. Even the prairie requires its corrals. Rights of way, allotments, orchards, buildings for the poor, and grave-yards must be taken into account before the average cost value of an acre in the typical parish can be estimated.

Beyond this there remains yet one noteworthy adjunct, which from the earliest time to the present has marked and capped every advance in civilization that has given character and value to country estates.

The owners of the soil, sometimes with enthusiasm, sometimes without, but still always somehow, have regarded the erection and maintenance of a place of public worship as a work without which their rural economy would be incomplete. To bring the expenditure on this head into the account is no fanciful or extreme stretch of the imagination, but would on reflection seem to be a solid actuarial item in the schedule of operations, by which our ancestors enhanced the value of every rood of their

possessions, and which must not be overlooked in discussion with those who trace so much of the rise of income to the natural increment of value.

There will now be no difficulty in accounting for an additional expenditure of 1600*l.* to 2000*l.* on the operations necessary in the selected parish to provide the equipment for the development of modern husbandry; this will raise the cost of the secondary operations to about 20,000*l.*, a sum equal to 12*l.* per acre. If we add 5*l.* an acre more for the cost of such work as Mr. Belcher describes in Wychwood Forest, we get a sum of 17*l.* per acre, and still we have not a house or homestead erected, a tree planted, a hovel raised. These particulars will be dealt with, and their importance as factors in the value of land perceived, when we come to the consideration of the actual expenditure about them on estates selected for example; but a very careful and useful estimate of their cost has been furnished by Mr. E. P. Squarey in his article on 'Farm Capital,' to be found in Vol. XIV. of the 2nd series of this 'Journal.'

Mr. Squarey says the landlord's capital is—(1.) The land. (2.) The buildings, roads, cottages, fences, &c. (3.) The expenditure in arterial or thorough draining, warping, chalking, marling, and other more or less permanent methods of increasing the productive capacity of the soil. It is with the second item we have now to do, and Mr. Squarey's estimates are based on the following illustrations:—

A. A dairy farm of 200 acres, 15 per cent. arable; annual value, exclusive of tithe, 50*s.* per acre; cost of buildings, including house and two cottages, 2550*l.*, or 12*l.* 15*s.* per acre.

B. Mixed arable and pasture farm, 500 acres tithe free at 30*s.* per acre rent; house, farm, and six cottages, 4000*l.*, or 8*l.* an acre.

C. Mixed upland, arable and pasture farm of 1000 acres, at 20*s.* per acre; farmhouse, buildings, and thirteen cottages, 6350*l.*, or 6*l.* 7*s.* per acre.

The average in these three illustrations of the cost of buildings turns out therefore to be 9*l.* per acre, which, added to the previous calculation of 17*l.*, brings up the amount of the owner's expenditure to the sum of 26*l.* per acre.

For some such outlay as this, or its equivalent, at the time when the several operations were carried out, the open wild waste, denuded of saleable timber, mere rough naked land in fact, has been converted into cleared and levelled enclosures, ready for the occupancy of the cultivating farmer and his staff.

Having thus taken a view of the processes involved in the making of the land, the consequence of these operations and

the further demand on the resources of those who have carried them out, in order that their efficiency should not be impaired, will have to be considered. This efficiency is maintained by renewals—renewals of operations and improvements which it is too much the custom to regard as permanent, when no such thing as permanency has been achieved. The life of these improvements is not perpetual, that of some is actually transient. If the primary operation, such as grubbing and levelling, be excepted, which once done may be said to be done for ever, there is not one that does not become from the date of its completion the source of anxiety in order to its protection and preservation, and of consequent further expenditure of capital.

The first execution of such works has all the charm of conquest surrounding it—it is greeted with the applause of admiring citizens, the successes are tabulated and advertised, the failures are never mentioned. While the field laughs with grain, it is more than possible that the owner groans at the cost of its artificial fertility, and finds too late that high farming is not the remedy for lowering prices. Too often he must feel it would have been better to have left the down unbroken, the copse ungrubbed, the gorse and heather to bloom in peace, the sullen clay undrained, the boulders where they lay on the moor, and the grand homestead in the architect's office. The mention of an inspector or commissioner sends the same sort of cold thrill through him as such references would among the criminal classes, and he curses the day when modern legislation enabled him through such agencies to burden his acres with debt, and to excite at the same time the cupidity of the ignorant and unscrupulous theorists who would appropriate what shadow of net income might remain to him, under a claim on behalf of the nation to the "natural increment of value." In such cases—and there are thousands of them—there is, instead of any natural increment of value, an artificial depletion of income.

As far as our experience reaches, the efficiency of modern under-drains cannot be counted on beyond a term of fifty years: in very many cases renewal has been found necessary at the end of thirty, either from the decay of the material used, as straw, turf, or wood, the defective design of the drain tile, as was the case in the old horseshoe tile, or the small diameter of the pipe, the inroads of moles, the entrance of roots, or deposit of silt and mud. Sometimes a zeal for universal deep work in soapy clays has ended in a suffocation of the passage, and caused an early substitution of shallower channels; sometimes the burial at the bottom of broken stones with pipes placed on their top, sometimes the direction in which the drains were set out, frequently the distances allowed between them, have speedily terminated

the useless life of the fashionable bantling, leaving a legacy of debt and a heavy charge inevitable for renewals.

The expenditure on such enterprises must not be forgotten by those who would record the cost of the subjugation of the English soil. It may be contended that money thus thrown away should not be taken into account. Be it so : but the experience derived from such mistakes, as an asset, has its value—a very sterling one —and something on its account must be credited in estimating the capital expenditure which goes to make up the value at the present day of ordinary farm lands. It is not the building of the vessels and the pay of the crews only that make up the cost of navigating our coasts: it is increased by a charge for beacons, buoys, and lights, warning the sailors of the hidden rocks and shoals on which so many have gone to destruction. The renewals of fences, where they have been neglected, is a constant source of expense, since (even where tenderly cared for) whitethorn and blackthorn and hazel are not immortal. The perpetual clearing out and deepening of outfalls, the renewals and repairs of fen and marsh banks and dykes, the maintenance of the machinery, without which it would be flooded, are continuous and costly, coming on some of the inferior levels to an annual cost of from 4*s*. to 6*s*. an acre.

Finally, it should be noted that it is upon land which in a state of nature was of an inferior value, either from its situation or poverty, that we meet with the marked instances of an appreciation of value due, as we have seen, to the lavish expenditure of extraneous capital. Fen districts, sandy heaths, vitriolic gravels, sullen clays, stony wildernesses, furnish the standard examples of improved rentals and reduced incomes. Arthur Young described one of his improved occupations in Middlesex as the "maw of a devouring wolf," the very reverse of the character an inexperienced observer would have bestowed on it.

One of the most successful and wealthiest men of business in the Midland counties, a very considerable landowner, whose family for a century back have been signally connected with the advancement of agriculture, told the writer forty years ago that "he could not afford to buy land at less than 90*l*. to 100*l*. per acre"—meaning, it may be presumed, that an income might be calculated on with certainty when the elements of fertility are in natural abundance and convertible into human food (as in the best grazing lands) without expenditure upon houses, cottages, and buildings; while in the other case, though the saleable products might be as considerable or even more so, the income they yielded was too seriously diminished by the cost of the artificial means

necessary for their acquirement. This reasoning seems to be sound, for it is notorious that the rents of these fine soils covered with the best natural pastures have hardly yielded to the pressure of bad times, while rents enhanced by improvements have gone to pieces, and in many cases down to zero.

Such examples as these are, however, of very limited amount, though possibly there is not a county in England that is entirely devoid of them. They will be found for the most part in the Midlands, and on the spots where the Kimmeridge clay and greensand come to the surface, as well as in river valleys and flats which for years have had the fertilising washings of the surrounding slopes brought down upon them by the action of frost and water. But even in the finest grazing pastures in Leicestershire and Northamptonshire, whatever may have been the practice fifty years ago, it would be wrong to conclude that at the present day the extraordinary richness of their grasses is due entirely to nature.

Some few years ago Sir John B. Lawes commenced a scientific enquiry into the causes of the fertility and the feeding properties of the best land near Market Harborough, and for this purpose he desired to select for examination portions of fields on which no artificial food had been consumed. After long search none could be found absolutely free from this disqualification. Upon the greater portion of this magnificent district it turned out that linseed or cotton cake was in common use and in considerable quantities, dissipating the general idea that the "rother's side is larded" solely by natural grasses. A little help no doubt goes a long way on such pastures, but the grazier has proved that it is better to give it—possibly with the view of early maturity—than to rely exclusively on what the landlord's freehold furnishes in return for the rent.

Passing then from the cream of the English soil, we come to the considerations of some instances selected for the purpose of showing the extraordinary and unsuspected outlay which has been continuously going on in order to produce or to maintain the rent-roll of purely rural estates.

It has been found no very easy matter to arrive at the particulars, or even the sum-total of this outlay, so as to get at a statement of averages. A vast amount of the improvements of the land has been due to sentiment and not to economical calculations. Arthur Young suggests the morning stroll of the owner, and his casual and unpremeditated conception on the spot of some operation which would improve the natural features of his estate, and perhaps employ his people, as the origin of considerable outlay. Of such probably no very accurate accounts are now to be found. Much of it perhaps might be

termed extravagant, and in respect of direct results, unproductive; but none can doubt that the finished charm and wealth of English scenery are traceable to such efforts, and that much of the value (the residential value certainly) of rural property has resulted from them. It is doing scant justice to our ancestors to discredit or forget their practical regard for ornament and progress as they understood it, and ungraciously ascribe its economic effects entirely to the "natural increment of value."

Fortunately, however, in some instances estate accounts have been kept and preserved in a manner sufficient to establish without doubt the contention that on a comparison of expenditure with the present capital value, much less than is thought will be found left for the prairie value of the land.

The county of Huntingdon is one essentially free from urban activity, and the local wealth which it creates. A considerable portion of it still shows traces of the forest with which it was once clothed. A large part of its north-eastern margin was very recently a fen sodden with moisture, or bright with water, skirted with reed and sedge.

The residents are the successors of a generation who were content to sow the skirts of their highlands where they dipped into the fens with no nobler grain than oats, to see them too frequently ripening so late that the practice was to leave them standing till the water rose among them a foot or more in depth, waiting with patience till winter set in, and access to the crop was afforded on the ice. Then at last, equipped with poles and sleighs, the villagers entered on the untimely harvest, and, breaking off so much of the crop as stood above the ice, they gathered it on the sleighs and removed it to the edge of the highland for storage.

The woods are now fewer and far between; the meres are bright, not with water, but with spring green and (in the absence of blight) with autumn gold. Spacious and substantial farmhouses and buildings have replaced the decoy and the charcoal-burners' camp, while the wattle and daub hut, with its thatched roof snug and picturesque, has disappeared for a modern brick substitute, answering indeed to the idea of decency and salubrity, but at the cost of rustic beauty and some domestic comforts.

Have these striking changes brought with them a corresponding financial return for the sacrifices which have been made for their achievement? Some answer may be found on an examination of a case in point.

The Connington estate, the property of J. M. Heathcote, Esq., in Huntingdonshire, is situated on the borders of the higher lands of the Oxford clay formation, where it descends and

merges into the alluvium of the fen lands of Whittlesea and Holme. Part, therefore, is heavy clay, the poorer portion of which is or was woodland and store-grass land. The other part is light fen land, "blowing" in the dry March winds, and of a loose texture. Situated between the two is a considerable amount of mixed soil of good quality, growing good timber, and carrying heavy sheep, and excellent pasture for milk and store cattle. For eighty-seven years the proprietors, a father and son, have resided on the estate, bestowing on it all the personal care and outlay which a love of country life and a sense of duty would prompt. Without yielding to "fads" and whims, all that modern science and practice in agriculture sanctioned has been respected and made use of here. Nothing seems to have been carried out on the one hand in a mean and niggardly fashion, while on the other there is no evidence of extravagance or indifference to economy.

The gross rental, inclusive of that from small holdings and cottages, has been as follows since the beginning of the century:

			£				£
In the year	1800	it was	3,603	In the year	1850	it was	7,004
"	1810	"	6,908	"	1860	"	9,592
"	1820	"	7,840	"	1870	"	10,376
"	1830	"	6,706	"	1880	"	7,185
"	1840	"	6,449	"	1886	"	7,130

But it must be remarked that the rental of 1886 is not all actually received from a tenantry, but is the sum given on the basis of a valuation; a large portion of the estate being in the hands of and cultivated by the owner.

The expenditure on the enclosure of one parish, the purchase of land, drainage, building, and repairs, or renewals, comes to no less than 143,798*l.*, as below.

	£
Farm premises, cost and repairs	41,311
Cottage repairs between 1860 and 1885 ..	4,564
Public drainage of fen, say	3,000*
Internal drainage of fen	11,213
Highland drainage	31,920
Road made	2,190
Purchase of land	44,089
Enclosure of one parish	5,511
Total	£143,798

The expenditure on residence, cottages, restoration of churches, special fen taxes, materials, and agency, brings up the capital

* Raised by an annual tax, averaging 116*l.* per annum, and extending over eighteen years.

sum expended to 218,446*l.* Now, supposing this sum had, as it accumulated, been hoarded instead of expended on this estate, and was to be now brought to light and placed out at interest of 4 per cent., an income of no less than 8738*l.* a year would be the clear result, or 1400*l.* a year more than the present gross income of the whole improved estate in 1886, after adding to the rental of 7130*l.*, 200*l.* for the mansion, making in all 7330*l.*

Supposing, which is believed to be the case, the outlay in question has been spread over the eighty-six years of this century, the estate may be debited with an annual charge in respect of one half of 218,446*l.* for eighty-six years, equal at 4 per cent. to 4369*l.* a year. Had this outlay never been made by the owner, it is not to be believed that the estate would have been unproductive. On the contrary, with security of tenure at a low rent, tenants would have been found to execute some improvements and renewals or repairs at their own cost. With a system of building leases even cottages might have been thus erected, as it is understood has been the case on one or more large estates. The owner might possibly have felt called upon to renew or rebuild the farm houses, to execute the arterial drainage of the fen land, and to take upon himself the enclosure of the open field parish, the repair of the churches, and the finding of some material. The estate is included in five parishes, and consists of 141 acres wood, 4557 acres arable, 1589 acres pasture, 800 acres fen land under plough. The highland cost 6*l.* an acre to under-drain, the tiles being made on the estate. The woodland produces no net return.

The estate of the Earl of Leicester, K.G., at Holkham in Norfolk, furnishes another striking illustration in support of the contention that value is due to outlay, and that some of the most splendid exhibitions of fertility and agricultural wealth are traceable, not to natural circumstances, but rather to the continuous systematic applications of skill and of extraneous capital on the soil.

In the following statement the Park and Domain, with the mansion and buildings pertaining to it, are excluded; as well as the Marsh farm of 459 acres.

The amount expended by the late Earl of Leicester on buildings and repairs from 1776 to 1842 was		£536,992
By the present Earl of Leicester for buildings and repairs, gates and fences, and under-draining, from 1842 to April 1st, 1883, was ..	£344,994	490,218
For purchase of land	145,224	
Total		£1,027,210

	£
The net income of the Estate in 1841 was	30,499
The average of ten years to 1841 was	25,208
The net income in 1860 was	26,746
The net income in 1882 was	25,402
The net income in 1885 was	27,523

It is interesting to examine, by the way, the payments which in the year 1882 came off the year's income of 52,285*l.*, amounting as they do to over one-half of this gross income. They were as follow:—

	£	*s.*	*d.*	£	*s.*	*d.*
Land tax	1,410	2	7			
Property tax	1,183	0	10			
Out rents	4,879	10	5			
Parochial rates	279	4	1			
Tithe rent charge	6,481	3	0			
Voluntary payments	680	17	7			
				14,913	18	6
Buildings and repairs	8,836	4	6½			
Gates and fences	401	1	5½			
Underdraining	1,192	14	7			
Law charges	146	7	3			
Management	1,303	17	10			
Sundry disbursements	81	2	9			
				11,961	8	5
Total .. .. .. say,				£26,875	0	0
Net profit .. .. say,				25,410	0	0

The average cost from the year 1852 to the year 1883 has been annually

	£	*s.*	*d.*
For buildings and repairs	8,083	6	0
Gates and fences	332	11	8
Underdraining	760	4	5
Total	£9,176	2	1

The amount annually expended in buildings and repairs alone from Michaelmas 1815 to April 1868, a period of fifty-two years, was 8371*l.* 18*s.* 3*d.*

Here we have an instance of an expenditure during 107 years of over one million sterling on one estate, in the purchase of land and in work and payments necessary to insure this rental of 52,285*l.* Applying the same rule as in the Connington case, and taking the interest of half this amount at 4 per cent. during the whole period, the proprietor from this source alone would have derived an annual income of 20,000*l.*, only 5410*l.* less than the net income of the improved and enlarged estate at the present time; or if the owners had only hoarded the sums annually spent on the maintenance of their estate during the period under considera-

tion, and had in the year 1883 brought the accumulation into beneficial use by investing it at the rate of 3½ per cent., the possessor would be in the enjoyment of an income of 36,000*l.* a year. The estate, less the amount purchased, would also be his, not indeed in the high condition which now distinguishes it, but still we may conjecture productive of some, though a considerably less, rental.

Having now given some instances of the expenditure of a large sum per acre in the reclamation and improvement of land in the eastern and northern counties of England, another may be added of a more ordinary character in the south-west, where the expenditure in relation to the rental has not been so considerable, and where the execution of the improvements has not attracted such general attention from its novelty or its extent. It gives, therefore, perhaps in some respects a truer sketch of the operations which have for years been quietly carried on by English landowners in the ordinary management of their estates.

The property in question belongs to Earl Bathurst, who has kindly furnished the following particulars concerning it. The purely agricultural portion, occupied by tenant farmers, consists now of about 6100 acres. In 1825 its extent was 4920 acres; nearly 1200 acres have been subsequently added by purchase from time to time at a cost of over 40,000*l.*

A home farm of 1209 acres, on which about 3000*l.* has been expended on new buildings and cottages, besides further sums on annual repairs, is not included in this statement. All contributions and subscriptions to the restoration of churches and vicarages, the maintenance of schools, the erection of a village coffee-tavern and similar matters, as well as the expenditure of 2300*l.* on a cattle-market upon the estate, producing an annual income of about 80*l.* from tolls, are omitted here from consideration. A sum of 1205*l.* is, however, included in the outlay of 1877, which was spent in the construction of water-works for the supply of one village and some high-lying land on two farms.

With regard to the rental, this from 1851 to 1879 was based on the price of wheat, when in the latter year the tenants expressed a desire to revert to fixed payments. The rent received amounted, on 4920 acres, in the year 1825, to 5521*l.*; in 1830, to 5519*l.*; in 1840, to 5904*l.*; in 1850, to 6143*l.* on 5290 acres; in 1860, to 7678*l.*, the acreage being then 5685 acres; in 1870, to 7780*l.*; in 1880, on 6100 acres, to 6560*l.*, and in 1885 to 6177*l.* on the same acreage. The consideration of these figures is instructive, showing as they do that in 1825 the gross rent was 22*s.* 5·3*d.* per acre as against 20*s.* 3·3*d.* in 1885, notwithstanding the outlay of 12*l.* per acre since that date.

The gross sum expended on the property between 1825 and 1885 inclusive came to 67,438*l.* on new farm-houses, buildings, cottages, general repairs, and draining, though only 1867*l.* is accounted for under this last head. As the cost of the purchased land, including law and other expenses, comes to about 42,500*l.*, there appears thus to have been a grand total of 110,000*l.* spent on a property which produced in 1885 a net rent of only 4600*l.*

The interest on 110,000*l.* at 4 per cent. is 4400*l.*, showing that within the last sixty years Earl Bathurst and his predecessors have practically bought and paid for their own agricultural property in hard cash. In other words, if they had not laid out a shilling in repairs on these agricultural holdings during the last sixty years, and had not purchased additional agricultural property for the improvement of their estate, but had invested the money so laid out at 4 per cent., the present owner would have been able to let the original agricultural estate of 4920 acres at one shilling an acre last year, and would be now actually in receipt of a larger return than he is possessed of under present circumstances.

It will be possibly urged that the cases quoted are exceptional, and not fair illustrations of the argument of the writer. Those who advance this objection would do well to bear in mind the length of time which has been occupied in bringing this fair realm into the condition in which we now find it; how impossible have been the operations without legislation; how slow and costly legislative processes are; how system after system has been abandoned and resumed under the influences of wars, treaties, and commercial changes; how sometimes the ignorant obstinacy of the wealthy or the popular prejudices of the masses have impeded or suspended remunerative operations; how sometime. violence has been used to put an end to the efforts of the improvers; and how the laws of real property, with their costly complications and the heavy demands of the exchequer, have closed the markets to those who might desire to realize on their improvements.

Let them bear in mind that the owner and cultivator of the soil has a fickle partner, from whom he can never divorce himself, in the person of Nature. Her whims and ways are beyond calculation. Mistress of such mighty agents as droughts, floods, frost and heat, she too often makes a disastrous end of the best devised schemes for improvement. You can impose no restraint on her. You cannot command the temperature of a county as you would that of a cucumber-frame or a factory; you cannot carry the sun in one hand and a watering-pot in the other. The most a prudent improver can do is to

humbly provide for contingencies, to remember that at present there are no exact rules of science under which he can conquer this dour earth of ours; and costly though it be, he must be content to do what, with no assurance of great reward, his ancestors have done before him—adopt those measures which many failures and much painful experience have shown to be of most service in the particular spot on which he applies his energies and resources.

Side by side with social progress the ameliorating changes have been advanced, not by the silent operations and development of Nature or by the natural increment of value, but by the dogged effort which the landowner as a rule has ever put forth in the making of the land, and at any cost fitting it for the practice of improved husbandry suited to the progress of civilization and the modern wants of the people.

XVI.—*Micro-organisms and their Action on Milk and Milk-Products.* By Dr. P. Vieth, F.C.S., F.I.C.

Under the general term of "fermentation" are understood certain changes and decompositions of organic substances. However different in their ultimate results they may be, all kinds of fermentation have one thing in common by which they are distinguished from processes, otherwise of a similar nature, viz. that very small quantities of the active agent (the ferment) which causes a particular kind of fermentation, are able to transform or decompose proportionately large quantities of the fermentable substance.

According to the nature of the ferment, the many different kinds of fermentation can be classed into two groups, viz. fermentations which are caused (1) by chemical ferments or Enzymes, and (2) by organized ferments.

Enzymes are *un*organized compounds, which are soluble in water. It is most difficult to prepare them in a perfectly pure state, hence very little is definitely known with regard to their chemical composition and constitution. Although enzymes are capable of effectively attacking and changing a very great multiple of their own quantity of the fermentable substance, it appears that during their action they are undergoing certain changes themselves, by which their efficiency is completely neutralized. By heating aqueous solutions of chemical ferments, the latter are rendered ineffective at a temperature much below boiling-point, viz. at about 170° Fahr. Instances of

fermentative actions caused by enzymes are the conversion of starch into sugar by diastase, the dissolution of albuminoids by pepsine, and the coagulation of milk by rennet.

The second group comprises those fermentations which are caused by *organized* ferments, and which at present are almost exclusively acknowledged as and called "true" fermentations. To this group belong the various kinds of fermentations which will be treated of in the following pages.

Although water containing organized ferments may appear quite limpid, such ferments are nevertheless not soluble. They are bodies with distinct outlines, of a well-defined form, in fact, "cells," to which, on account of their microscopic size, the name of "micro-organisms" has been given. Micro-organisms are the active agents in the decomposition of sugar into alcohol and carbonic acid, the transformation of alcohol into acetic acid, and the splitting up of milk-sugar.

It is well known that the lowest forms of animal and vegetable life are of so simple and similar a character that it frequently becomes very difficult to decide to which kingdom they belong. The difficulty is increased by the fact that vegetable cells not infrequently exhibit a considerable power of locomotion, which may easily lead to the assumption that they are animals. This is the case, for instance, with several forms of micro-organisms occurring in milk. Although until a short time ago much difference of opinion existed on this point, the micro-organisms which cause fermentative decompositions are at present generally recognized as belonging to the vegetable kingdom. Indeed they differ in no way in their structure from the young cells of living plants of higher orders, and exhibit in a great many respects a striking similarity to certain kinds of fungi and algæ.

Micro-organisms consist of single cells, or several united, possessing a cellular membrane, in which is enclosed a viscid nitrogenous substance, protoplasm; there are further present minute particles of fat, as well as mineral salts. When brought under suitable conditions, these cells multiply in the following manner:—A parting membrane is formed, making two cells out of one. These two cells grow, and both soon reach the size of the mother-cell, when new divisions take place. The newly-formed cells either separate entirely, or they are notched around the point where the divisions took place, still remaining united, and forming beads or chains: or else no indentation takes place, and threads of cells are produced. The chains or threads may be single rows, or have ramifications.

Sooner or later there occurs a stage in the life of these organisms at which their power to produce new cells by

division becomes exhausted, and in certain cells a concentration of the contents then takes place, thus forming very small corpuscles. These are the spores, which are destined to preserve the species to which they belong after the parent-plant has died; and they are well adapted for this purpose, since their resistance to external influences, such as cold, heat, dryness, &c., is very great, indeed far beyond the resisting power of the developed plant.

In consequence of their lightness, these spores easily float about in the air, which is, therefore, always more or less charged with them. When they enter a medium which offers conditions suitable for their development, they grow into cells. These cells live and multiply in the manner just described. At the same time the medium will undergo certain changes, or in other words, fermentation. This is not merely the result of the presence of micro-organisms, but the consequence of their development and physiological activity.

The action of micro-organisms or organised ferments does not exclude entirely the action of chemical ferments or enzymes. One organized ferment, common yeast, has been proved beyond doubt to contain in itself an enzyme capable of converting unfermentable into fermentable sugar, which in its turn is then acted upon by the yeast and undergoes alcoholic fermentation. Rennet is said to have been found in micro-organisms living on the casein of milk, and other organisms of a similar kind are supposed to contain a chemical ferment capable of dissolving casein.

Milk has often, and very rightly, been described as a model food, for it contains in the most assimilable form all those compounds which are necessary for the sustenance of life, viz. nitrogenous matter (casein, albumen), fat (butter), carbohydrates (milk-sugar), and mineral salts (chlorides and phosphates of potash, soda, lime and magnesia, besides traces of other salts). These are exactly the constituents of micro-organisms, and it is, therefore, not at all surprising that milk, containing at the same time the necessary nutriment and fermentable substances, should become a very suitable medium for the development of a number of micro-organisms.

It has been mentioned that our knowledge of micro-organisms and their action is, comparatively speaking, of very recent date. Thanks, however, to the researches of Pasteur and other investigators, this branch of science has been much advanced during the last two decades.

Lactic Ferment.—That milk after having been drawn from the udder and kept for a certain time, turns sour, loses its liquid character, and—provided it has not been disturbed—forms a

gelatinous mass, is such a familiar occurrence that one is almost inclined to look at this change as an inevitable and quite natural one. If the temperature of the gelatinous mass be raised, or if the latter be broken up, a separation takes place, the precipitated casein, including the fat, settling down in the form of curd in an almost bright liquid, the whey. An apparently similar occurrence takes place when rennet is added to milk at a suitable temperature. The two cases are, however, totally different.

Normal milk when quite fresh exhibits, in consequence of some mineral salts which it contains, an amphioteric reaction, *i.e.* it turns red litmus paper slightly blue, and blue paper slightly red. The spontaneous coagulation of the casein never takes place before the milk has attained a decidedly sour reaction, and it is indeed a consequence of the formation of lactic acid, the product formed by the decomposition of milk-sugar.

It used to be contended that also by the addition of rennet, lactic acid was first produced, which in its turn precipitated the casein. That this, however, is not the case, can be proved by the fact that rennet will coagulate milk to which an alkali has been added in such quantities that not only the milk employed but also the whey produced exhibits alkaline reaction.

As mentioned before, the "turning" of the milk seems such a natural occurrence that formerly it was believed that milk in its normal state, and even before it had been drawn from the udder, contained the principle or ferment which causes the decomposition of milk-sugar into lactic acid, and consequently the coagulation of the casein.

Very curious notions were indeed entertained with regard to the nature of this ferment. One investigator, about fifty years ago, believed that the milk globules (which in reality consist of the finely-divided butter fat) develop or grow into a kind of mould, which acts as a ferment; whilst a well-known chemist asserted, only thirteen years ago, that it was the casein in milk which caused the lactic fermentation of the milk-sugar.

If it were the case that milk carried with it, as a natural constituent, a ferment setting up lactic fermentation, it would be impossible to get a sample which would not curdle in a comparatively short space of time. If, on the other hand, the ferment is not contained in the milk whilst still in the udder, or when drawn from it under proper precautions, but enters it from outside after it has left the cow, one ought to be able to obtain samples which will keep sweet, under suitable conditions, without having to undergo any process of preservation or sterilization.

In opposition to the views previously mentioned, Pasteur con-

tended, as far back as thirty years ago, that lactic fermentation is caused by an organized ferment which enters the milk after it has left the udder, that this micro-organism is the only cause for the formation of lactic acid, and that in its absence no such decomposition of the milk-sugar takes place.

In order to decide the question in a practical way, Lister and others made experiments, in which they tried to get milk samples under conditions excluding as much as possible external influences, especially guarding them from the possibility of coming in contact with germs from outside. This seems perhaps easier than is really the case, and success was at first very doubtful. But after some practice in conducting the experiments, many samples were obtained which did not undergo decomposition, thus proving that a ferment common to milk could not have been present, but that the cause of lactic fermentation certainly enters the milk from outside. When the different samples of milk were examined microscopically, all those which had kept well were found to be free from micro-organisms, whilst those which had undergone decomposition invariably contained them.

Every drop of milk obtained in the ordinary way, when examined under the microscope, is found to contain a number of micro-organisms of different forms which are by no means similar, but vary in accordance with the locality and other surrounding circumstances. If the milk be kept until it turns sour, it is observed that one species of organism multiplies more rapidly than all the others, thus making it most probable that this special kind stands in close relation to the progressing lactic fermentation. Lister tried to separate the different kinds of organisms, and to study their individual effects in the following way:—

In a very small but definite quantity of sour milk the number of micro-organisms was ascertained by the aid of the microscope. A certain quantity of this milk was then diluted with sterilized water to such an extent that on an average rather less than one organism was present in each drop of the liquid. Five glasses each containing sterilized milk were then inoculated with one drop of the diluted milk and kept guarded from outside influences. The milk in four out of the five glasses underwent neither lactic nor any other kind of fermentation, and no organisms could be detected. The fifth sample, however, turned sour, and was found upon examination to contain the lactic ferment in abundance. Starting from this latter sample, which was presumed to contain the pure lactic ferment unmixed with others, a further experiment was made, by inoculating sterilised milk so that one sample was supposed to contain four organisms, five samples two organisms, and ten samples one organism each.

The results were that the first and second samples curdled within a few days, but of the third lot, viz. the ten samples

each supposed to contain one organism in the sterilized milk, only five curdled, whilst five remained fluid, sweet, and in every way unchanged for a number of weeks. The curdling was in every case accompanied by the development of a definite kind of organism, while in the five samples which remained sweet this was entirely absent.

A more certain way of proceeding, when a separation of different kinds of micro-organisms is contemplated, is that suggested and practised by Koch:—

Sterilized nutritive gelatine is spread out upon a glass plate. A platinum pin previously ignited is dipped into the milk under examination, and with the pin a line is drawn upon the gelatine plate; this is then exposed to a temperature suitable for the development of micro-organisms. All these operations are carried out under such precautions as will preclude the possibility of outside influences, which, if not entirely prevented, are certainly diminished to a very great extent.

After the lapse of a few days, finely-drawn white lines or detached spots are noticed, each spot representing a colony of micro-organisms developed from a single germ. The lines are formed of colonies closely situated to each other. As these colonies develop, differences in the manner of their growth will be observed. Many will be found to resemble one another, whilst in others the differences are more pronounced, and upon closer observation micro-organisms different from the rest will be found.

Should the material for inoculation have been taken from sour milk, by far the greater number of the colonies will be of a very similar character. On the surface of the gelatine they will grow to the size of a lentil, of a white porcelain-like colour and encircled by smooth, not dented, outlines. Other colonies, which at the earlier period of growth may exhibit a similar character, show decided differences in their further development.

In order to prove whether the germs which form the colonies described have any connection with the lactic fermentation of milk, it is necessary to prepare perfectly sterilized milk. This can be done by keeping small samples contained in suitable vessels in boiling water, or better still, in steam of the temperature of boiling water for several hours, or by heating the samples up to 160° Fahr. for one hour daily on five consecutive days. Samples thus treated and secured against contamination from outside will undergo no perceptible change for as long a period as twelve months. If, however, the point of a pin be brought into contact with one of the colonies described, and be then dipped into the milk, and the latter exposed to a temperature of 100° Fahr. (always preventing contamination from other sources), the milk will be found to become coagulated

within twenty-four hours. Upon microscopic examination, one kind of micro-organism only is now observed in the milk. To make the matter free from all doubt, it is necessary that quite pure cultivations should be used and their effects studied.

From a colony raised in the first instance, a second gelatine plate is inoculated; after the development of new colonies, a third, fourth, and fifth plate is taken, and so on until the possibility of having anything of the original material left is quite out of the question. In one case, a series of seventy-eight distinct cultivations was made in this manner, and no alteration with regard to shape or effect of the ferment was observed.

The ferment consists of short cells which are not much longer than they are broad, and are generally in pairs with their ends joined together. To an unpractised eye they would appear to be nearly oval, and a double cell would seem to be notched all round at the division; but upon careful examination under suitable conditions they are found to have parallel sides and only slightly rounded ends. There are also somewhat longer rods, in which a segmentation into two cells is about to take place. The cells are motionless, and from their character they must be classed as bacilli.

In some instances the formation of spores has been observed. Upon one end of a single or both ends of a double cell, an excrescence can be seen, which is of a very high refractive power. When such cells are subjected to the heat of boiling water, which suffices to kill the full-grown bacilli, it is found that fresh cells are developed in a suitable medium.

This bacillus can live and develop in certain media without undergoing any alteration, and without producing any decomposition. As soon, however, as it is introduced into milk, it gives rise to the formation of lactic acid and the subsequent coagulation of the casein.

That lactic acid and no other acid is formed has been ascertained by separating the acid in the form of metallic compounds, and determining their character and behaviour. The quantity of milk-sugar is diminished, corresponding with the increase of lactic acid.

It is not upon milk exclusively that the bacillus is able to act and cause decomposition, but it also sets up lactic fermentation if introduced into solutions of milk-sugar, cane-sugar, dextrose, and mannitose. It seems, however, that in the case of milk-sugar and cane-sugar, a hydration, *i.e.* an addition of the elements of water to those of the sugar, precedes the decomposition. As the action of chemical ferments consists chiefly in causing the elements of water either to be added to or split off the substance acted upon, it has been suggested that, like other organized ferments,

the bacillus causing lactic fermentation contains a chemical ferment. So far, however, all efforts to isolate the latter have failed, and with our present knowledge we are unable to say whether or not the hydration, like the more noticeable decomposition, is purely a physiological action of the micro-organisms.

It appears that lactic fermentation cannot proceed except in the presence of free oxygen, although very small quantities of the latter are sufficient to produce in milk as much acid as is necessary to coagulate the casein. The presence of a certain quantity of acid interferes with the further action of the ferment. Less than one per cent. seems to be the maximum quantity of lactic acid which can be produced in any solution. The complete conversion of a given quantity of sugar into lactic acid can therefore only be effected if care be taken to neutralize the acid formed, by the addition of carbonate of lime or the like. Besides lactic acid, small quantities of carbonic acid are formed; other products of decomposition have not been discovered.

The influence of different temperatures on the development and consequent action of the bacillus is of great practical importance. Whereas at a temperature below 50° Fahr. no development can be observed, lactic fermentation sets in at 55° Fahr. although proceeding very slowly. At 60° Fahr. the development is more active, but it still takes a comparatively long time before sufficient lactic acid is produced to coagulate the casein. At five degrees higher a very marked difference is seen, and at a still higher temperature the progress of fermentation is considerably accelerated, until the maximum effect is reached at about 100° Fahr. With a temperature of 107° Fahr., the rapidity of the formation of lactic acid diminishes in a noticeable degree, and it ceases altogether at 114° Fahr.

It has been contended that the bacillus under certain conditions undergoes some change, resulting in the formation of other kinds of cells, and that in its altered state it does not cause lactic fermentation, but peptonization of milk. These statements must be confuted as erroneous and based upon unreliable observations. When working with really pure cultivation of the bacillus, no other than lactic fermentation has ever been observed; but it is not an easy matter to get pure cultivation, and no other method than that of Koch, previously mentioned, is likely to answer the purpose.

All the experiments made with a view of extracting from milk a chemical ferment capable of producing lactic fermentation have failed. When lactic acid was produced, the specific micro-organism could be found; and where the latter was entirely absent, no formation of lactic acid took place.

Butyric Ferment.—It has been observed that in milk subjected to heat with a view of preserving it, coagulation of the casein takes place after a time. Upon examination it is found that the reaction of the milk is alkaline, and that it contains no lactic acid. In such milk, when examined by the aid of the microscope, a bacillus is found, which even on superficial observation is distinguished by its larger size from the bacillus which causes lactic fermentation, and the action of which upon milk is very different.

If sterilized milk be inoculated with this organism, as obtained in pure cultivation, and exposed to a temperature of 100° Fahr., certain changes will become visible on the second day. A light yellowish liquid is noticed below the cream layer, which is a sign of the beginning of the precipitation of the casein. The volume of this liquid extends downwards more and more, the top part nearest to the cream becoming quite clear, while the lower portion remains cloudy and covers a coagulum of precipitated casein. The quantity of the latter is gradually diminished with the length of time the experiment is continued.

Upon examination, the liquid formed is found to contain several products of decomposition of casein, such as leucine, tyrosine, and ammonia, while at the same time a slightly bitter taste is observed.

The action of the ferment can best be described as causing, first, the coagulation of the casein in a similar manner to rennet, and then exercising a peptonizing influence by which the casein is transformed into soluble compounds. Besides these chemical changes, the same bacillus is able to effect a perfectly different change if the conditions be varied. This bacillus is unable to act either upon milk-sugar in its unaltered state, or upon free lactic acid, as free acid interferes with its development. If however it is brought in contact with a solution containing inverted, or hydrated, milk-sugar, or salts of lactic acid, a fermentation is set up, by which butyric acid is produced. When speaking of lactic fermentation we mentioned that it was preceded by a hydration of the milk-sugar. Butyric acid can therefore be formed in unpreserved milk, and the same action takes place in solutions of other sugars, starch, and similar substances. The presence of increasing quantities of the butyric acid formed does not appear to interfere with the further growth of the ferment.

The very fact that in milk which has been successfully preserved against lactic fermentation the alteration described above can take place, proves that the bacillus which causes butyric fermentation has a greater resisting power against heat

than the bacillus of lactic fermentation. Of the latter it has been said that it cannot exist without free oxygen, and that free access of oxygen stimulates its development. To the bacillus of butyric fermentation, on the other hand, free oxygen appears to be of little importance. Except in this one respect, the bacillus shows no difference from that which has been studied by others.

The bacillus has the form of rods which are motionless while young, but after several divisions have taken place they commence to move about, either singly or in chains consisting of several individual cells. They appear to be attracted by solid nutriment, and adhere to it for a time rather firmly. They are from three to ten times longer than they are broad. The cells complete their growth in length first; they afterwards increase in width, and lastly the spores are formed. The rods are either straight or curved. With regard to the influence of temperature, it has been found that a lower temperature retards and a higher stimulates the development, and consequently the fermentative action. The most suitable temperature has been ascertained to be 95° Fahr.; at a higher temperature than this the bacillus is destroyed. The spores will stand a boiling heat for five minutes very well; ten minutes interfere with them seriously, and a complete result is doubtful; after fifteen minutes' exposure none survive.

Alcoholic Fermentation.—It is generally known that by the addition of yeast to solutions of sugar extracted from plants, or produced by the conversion of starch, a decomposition is effected, the chief products of which are alcohol and carbonic acid. Alcoholic fermentation can be pronounced as the most widely known, best studied, and most extensively applied process of its kind. In connection with milk, however, it is only within the last few years that any attention has been paid to it.

What is known as yeast, when examined under the microscope, is seen to consist of small cells possessing all the characters of vegetable cells. The cells, which are generally oblong, augment by budding; they are present in the fermenting liquid, either singly, or a few joined together, or a greater number forming chains. When introduced into solutions of those kinds of sugar which do not readily undergo lactic fermentation, active alcoholic fermentation will be started in a very short time. On the other hand, those kinds of sugar which are split up into lactic acid without difficulty do not easily form alcohol and carbonic acid. To the latter class milk-sugar belongs, and it is therefore not surprising to find that little is heard of the alcoholic fermentation of milk.

There is indeed some difficulty experienced when trying to start alcoholic fermentation in milk. As is the case with butyric

fermentation, the first condition is that the milk-sugar be converted into a sugar of a more simple composition—a transformation which is effected by the bacillus of lactic fermentation, and perhaps also by lactic acid. We find, therefore, that alcoholic fermentation does not take place in sweet milk, and even after the latter has turned sour it is not possible to easily produce alcoholic fermentation by the addition of common yeast, a special ferment being necessary. During the last few years such a ferment has become known under the name of "Kephir" ferment. It was discovered in the Caucasus, where it appears it has been used from time immemorial for the manufacture of a native beverage. The ferment in the form in which it is used consists of small lumps differing in size from that of a pea to that of a hazel-nut, irregularly shaped and somewhat resembling cauliflower, of a dirty grey or yellowish-brown colour. When examined microscopically these lumps (or "grains" as they are called), are found to consist of three different species of micro-organisms; first, the bacillus of lactic fermentation; second, a larger bacillus; and third, a cultivated yeast.

The yeast cells are apparently not distinguishable from the common beer yeast. Like the latter, they do not form spores, but multiply by budding only. With regard to the larger bacillus, new cells are formed by means of divisions taking place. The newly formed cells either separate, or remain connected, forming long threads. There are also found aggregations of cells, united by a sticky, slimy mass; single cells are frequently seen moving about. The formation of spores invariably takes place, so that two spores are formed, one at each end of the cell.

There can be no doubt as to the part which the bacillus of lactic fermentation plays; it decomposes part of the milk sugar into lactic acid, and carbonic acid. Another portion of the sugar gets hydrated under the influence of the same organisms, and is then decomposed by the second micro-organisms present, the yeast cells, alcohol, and carbonic acid being formed as the result of their action. Although one must suppose that, besides alcohol and carbonic acid, traces of other bodies, such as glycerine, fusel oil, and succinic acid, are formed as bye-products, as is the case when alcoholic fermentation takes place in sugar solutions, there is no evidence to show that the presence of these bye-products has ever been proved in fermented milk. A further change which takes place consists of the partial peptonization of the casein and albumen, and this must be assigned to the action of the larger bacillus.

The presence of the three forms of micro-organisms in combination appears to be necessary to effect the changes described. The result of the action of Kephir grains upon milk is a beverage

which, with regard to its component parts, behaviour, and medicinal properties, is very similar, not to say identical with Koumiss, a somewhat better-known preparation, which also consists of fermented milk. Kephir grains grow very considerably when kept in contact with milk ; in other liquids a similar result has not been observed.

Slimy Fermentation.—In some parts of Norway and the north of Sweden people are said to be rather fond of ropy milk, and use it as a regular article of diet. According to accounts repeatedly published, the ropy milk is prepared either by giving the cows grass or hay containing a plant, the botanical name of which is *Pinguicula vulgaris*, or by rubbing with this plant the interior of the vessels used for storing the milk, or by immersing a bunch of it in the milk. The milk then gets ropy, the cream is prevented from rising, the taste is insipid, and after some time it becomes slightly sour. The keeping quality however is said to be very great.

In other countries where a taste for milk which cannot be measured by the quart, but which has to be sold by the yard, does not exist, milk getting slimy or ropy is looked upon as rather an unfortunate occurrence. Almost the only account to which such milk could be turned would be to churn it, but even then some difficulties would be met with. The yield of butter would be very small, and the keeping quality, as well as the taste, decidedly inferior.

With regard to slimy and ropy milk the most divergent opinions have been brought forward. As to the time when the irregularity is more generally observed, some pronounce that it is during the summer, while others find the winter more favourable to it, and a third set of persons say that the time of year makes no difference. As to the causes which, according to different writers, account for milk getting ropy, we find them as varied as can possibly be :—illness of the mammary glands, inflammation of the udder, cold of the same organ contracted by lying down on the ground, atmospheric influences, fodder grown on certain soil or containing certain plants, or fodder badly harvested, inferior crushed grain, distillery wash, damp and badly ventilated milk rooms, unclean rooms and utensils, and others.

The remedies suggested are equally varied, such as treating the cows with medicines composed of aromatic herbs, laxatives, common salt, spirits of salts in a decoction of linseed, letting blood, change of diet, disinfection and change of milk-room, and thorough cleansing of all articles and utensils which are likely to come in contact with the milk.

These alleged causes of, and suggested remedies for, ropy milk point to two assumptions, viz. either that the milk when

drawn from the cow is already infested with the ferment which later on leads to its becoming slimy, or that the milk is infected at a stage after it has left the cow. The first assumption has not yet been disproved, no experiments having been made to show that milk which has been drawn from the cow under proper precautions will never get ropy. The second assumption however has been fully proved in practice, as well as by scientific experiments. Undoubtedly sound milk brought in contact with, or even kept in the same room with, ropy milk, soon becomes ropy also. When ropy milk is subjected to microscopic examination, it invariably exhibits small cells of very high refractive power; these cells are either single or united in bead-like chains.

If sterilized milk be inoculated with ropy milk and kept at a suitable temperature, it will be observed that no cream rises to the top, and that the milk gets ropy within twenty-four hours; it is then slightly acid. After forty-eight hours have elapsed, the milk is of such a consistency that it will not flow out of the vessel containing it, even if the latter be turned upside down.

If in place of milk whey be infected, and also if a solution of milk-sugar containing small quantities of nitrogenous bodies, and certain mineral compounds be operated upon, the effect is the same, although perhaps not quite so marked. Solutions of casein or albumen, on the other hand, are not affected by the inoculation of ropy milk, showing that it is not the nitrogenous compounds, but the milk-sugar which is attacked. Corresponding with the advance of the fermentation, the quantity of milk-sugar is more and more diminished. By examination with the microscope a micrococcus has been found to be present in slimy milk.

The most suitable temperature for this development is between 86° and 104° Fahr. With the rise of temperature, the energy of the micrococcus is diminished, and at 140° Fahr. it is altogether destroyed. If ropy milk, however, be dried at relatively low temperatures, and the dry mass exposed to a temperature of 212° Fahr. for several minutes, it does not lose its infective character. Freezing prevents the development of the micrococcus and the exercise of its effect, but it does not kill it.

There exists another micro-organism generally causing slimy fermentation and very commonly found upon potatoes, which is also able to act upon milk. It is a micro-organism of a different form belonging to the class of bacilli, and its action on milk is very different from that of the micrococcus previously described.

The bacillus when introduced into sterilized milk first causes precipitation, and afterwards dissolution of the casein, which latter

however does not proceed so far as in the case of the bacillus of butyric fermentation. The dissolution of the casein is in both cases due to peptonization. The liquid which is formed between the cream layer and the undissolved casein is of a yellowish colour and slightly alkaline, but neither ropy nor slimy. The cream layer, however, is ropy, and the lumps of coagulated casein at the bottom of the liquid are enclosed by a slimy mass containing great numbers of the bacillus. In this case then it is not the milk-sugar, but the albuminous matter in the milk which is undergoing slimy fermentation, and the question may be asked whether the two distinct kinds of slimy fermentation occur in practice. Hitherto they have not been kept separate, and this is not surprising, as the phenomena have been but very little studied. In future it might be advisable to pay more attention to the subject, and this the more as we may suspect a close connection between the one kind of fermentation described and the bacillus growing on potatoes. Such hints are worthy of being kept in mind should opportunity arise for a remedy against what must be described as a serious disturbance of practical dairying.

Those observers who believe that slimy and ropy milk is a consequence of certain kinds of food, and who have found that with a change of diet the disturbance has disappeared, have been thereby the more convinced of the soundness of their opinion. But they seem to have entirely lost sight of the fact that a certain kind of feeding stuff may exercise an unfavourable influence on milk in a much more direct way than through the organs of the cow. When ensilage was first introduced as an article of diet for milch cows, the cry was raised from a great many quarters that it imparted its flavour to the milk and the butter. At the present time, it is well known that the milk of silage-fed cows is not tainted in any way, if only proper precautions be taken to have the cows milked by people who have not handled the silage a short time previous, and not to allow the milk to remain exposed to air which is tainted with the smell of silage. In like manner it can be imagined that a certain kind of food may be infested with micro-organisms, which, getting diffused in the air of the cowsheds, enter the milk and set up in it a certain kind of fermentation. If the food in question be removed, the ferment is also banished, and the complaint no longer exists.

Blue Milk.—What has been said about the opinions which used to be entertained as to slimy and ropy milk might almost be repeated word for word with regard to the phenomenon of blue milk. There is, perhaps, this one difference, that in the latter case more than in the former a greater number of practical observers

are inclined to look on the causes of blue milk as not being due to pathological conditions of the cow, but rather to external influences acting upon the milk after it has been drawn from the udder. It has been fully proved that the production of blue-coloured milk is due to the action of a micro-organism.

If nutritive gelatine be inoculated with blue milk, the growth of colonies will be observed. The colonies differ in appearance, some forming spots of a pure white, others of a yellowish white colour, the gelatine surrounding the latter being of a greenish tint. If these colonies are used separately for the inoculation of milk, those samples only which contain the micro-organisms of the yellowish white colonies will get blue.

On raising pure cultivations of this micro-organism it is found to be a bacillus, which multiplies by dividing; the cells separate, and move about singly, and at last form spores, not more than one spore being formed by a single cell. Upon milk which has been inoculated, intense blue patches are seen to appear at about the same time that the milk gets sour. The slower the lactic fermentation proceeds, the more the patches spread out, and the better their colour develops. Blue milk reaches a less degree of acidity than other milk.

If perfectly sterilized milk be inoculated, the appearance is different. The milk does not turn sour, but remains liquid, and shows after a time alkaline reaction. The coloration commences on the cream, and spreads more and more, gradually working downwards through the whole of the liquid. In case the milk had been slightly sour when sterilized, the colour will be a light blue, but in case the reaction of the milk had been amphioteric, the milk will assume a slate colour, which turns into a bright blue upon the addition of an acid. The brilliant blue colour is not produced unless there is some free acid present. The bacillus, however, does not give rise to the formation of lactic or butyric acid, but, on the contrary, seems to live upon them if present, for slightly acid milk gradually becomes neutral and even alkaline.

The reason why in milk the blue colour makes its appearance in smaller or larger patches, while in sterilized fresh milk it diffuses itself throughout the whole mass of the liquid, is to be found in the fact that the bacillus acts upon the casein, and that where the latter is coagulated the action gets localized to some extent. That the milk-sugar is not attacked has been proved by its undiminished quantity. Pure solutions of casein assume a slaty colour after inoculation, as also do solutions of other substances containing nitrogen. In certain solutions a green colour is produced.

The bacillus does not develop at a temperature below

50° Fahr. Between 50° and 55° Fahr. its action commences, but only in a slight degree. The most suitable temperature is from 60° to 65° Fahr. Above 65° Fahr. there is observed a decrease in the time, but no increase in the intensity of colour. With a temperature of 77° Fahr. the power of acting further decreases, and it ceases altogether at 99° Fahr.

The assumption that the milk or its colouring principle is poisonous is in no way supported; on the contrary, experiments have shown that small animals which were fed upon blue milk, or injected with the pure cultivated bacillus, did not suffer any harm. The assumption is based on the belief that the blue colour is an aniline colour, and that all aniline colours must be poisonous. The latter is not at all the case; and as to the character of the coloration of blue milk we know nothing up to the present.

As far as the formation of pigments on or in milk is concerned, "blue milk" appears to be the only phenomenon of its kind which has attracted general attention, and the cause of which has been thoroughly studied. The bacillus described is, however, not by any means the only one which can produce a certain colour in milk, as there exists another bacillus which in its form and action upon milk very closely resembles the bacillus of blue milk, but produces a slight green coloration. A third bacillus also colours milk yellowish green, but at the same time coagulates, and in its further progress peptonizes the casein. A fourth also acts in exactly the same manner on the casein, producing spots which are in the first place of a deep blue colour, and gradually become darker until they are almost black. There are known, furthermore, two forms of micrococci, the one coagulating the casein, but not exhibiting any peptonizing power, and colouring the milk yellow to orange, the other producing a colour of an intense red.

Oidium Lactis.—This fungus is mentioned here because to it effects have been ascribed which in truth are produced by one of the micro-organisms mentioned above. The fungus, which forms a thick growth of white colour, is invariably found on sour milk, and this fact has led to the belief that to its presence is due the production of lactic acid and the coagulation of the milk. Although the fungus prefers for its growth slightly acid media, it develops rather luxuriantly also in neutral, but indifferently in alkaline substances. The most suitable temperature is from 60° to 70° Fahr. If sterilized milk be inoculated with the purely cultivated fungus, it remains fluid, does not get sour, but, on the contrary, becomes slightly alkaline. There can be no question that the fungus has no connection with lactic fermentation, except perhaps that it uses

up part of the lactic acid formed, and thus enables the bacillus of lactic fermentation to decompose a larger quantity of the milk-sugar present.

Preservation.—In the preceding pages an account has been given of those micro-organisms which at the present moment are recognised as exercising a definite fermentative action on milk. In places where milk is constantly kept, it must be expected that at least some of the organisms described will be present in abundance, and the utmost cleanliness is therefore necessary in order to keep them in check, so that they cannot interfere in too serious a manner. It must not be supposed, however, that besides those mentioned other organisms do not occur. Whenever milk comes in contact with the atmosphere, as it does largely when being handled, it must also come in contact with germs floating about in the air, and retain a number of them. The more contaminated the air, the greater number of germs will the milk retain. When cows are housed, more foreign matter may be expected to enter the milk than when they are out on grass, and it is a common observation that, unless special precautions are taken, milk from stall-fed cows generally is found to contain a sediment consisting of dust of food and the like. The spores of mildew are frequently present in this sediment, but pernicious as these parasites are to the plants which they inhabit, they are not known to have any injurious effect on the milk.

Other organisms which may find milk a suitable medium to thrive in do not seem to set up in it a fermentative decomposition, and therefore do not come strictly within the scope of this paper. But although the milk may not be affected by their presence and development, they may have a very deleterious effect upon the consumer of it. The subject of the spreading of infectious diseases through milk containing the contagium of those diseases has of late been brought before the public very prominently and upon numerous occasions. For this reason, and because what we shall have to say with regard to the checking or destroying of the micro-organisms refers alike to all of them, we venture briefly to touch upon this question.

Although it can by no means be said that in all the cases in which epidemics have been assigned to infected milk, it has been proved beyond doubt that another common cause could not have existed, and that milk was indubitably the means by which the contagium had been carried and communicated to the sufferers, it must be admitted that in some cases the evidence obtained has pointed so strongly and exclusively to a common milk-supply that it had to be taken as proof conclusive of

the latter being at fault, especially when it has appeared from that evidence that a connection existed between the milk and a previous case of the disease in question.

There are three ways in which milk can contract infection, so that it becomes a source of danger to the consumer :—1. Through the air. The gases emanating from privies and sewers are most likely to carry dangerous germs, and, by coming in contact with milk, to infect it. 2. Through water ; this is frequently highly contaminated when proper precautions are not taken that no intercommunication exists between wells and sewers, cesspools, and the like. The fraudulent addition of such water is not necessary, as simply washing the vessels used for the conveyance of the milk will suffice to contaminate the whole supply to an alarming extent. 3. There is the possibility of the milk-supply being derived from cows suffering from certain diseases.

It has often been contended that the milk from cows suffering from pleuro-pneumonia gives rise to consumption in man. Milk from cows suffering from foot-and-mouth disease is known to have produced in some instances (not in all) aphthæ round the mouths of those who had partaken of it ; and not long ago an outbreak of scarlatina was traced to milk from cows suffering from a peculiar skin disease affecting the teats and udder, and, in severe cases, other parts of the body of the animal. This is not the place to examine whether and how far the connection between diseases in man consuming milk from ailing cows, and the ailments of those cows, is based upon indisputable facts. What we desire to point out is, that the danger of particles of ejections from the lungs, runnings from the mouth, and chippings from the skin, entering the milk certainly exists.

The dangers arising from foul air, contaminated water, and diseased animals can be, if not altogether avoided, at least reduced to a minimum by having properly situated and constructed rooms to keep the milk in, by using boiling water and steam for cleansing purposes, by careful sanitary inspection of cows, and by separating those which exhibit even the most insignificant signs of ailments and destroying the milk yielded by such animals.

In the foregoing we have always assumed that micro-organisms enter the milk from outside, and after it has been drawn from the udder. The question arises—are there ever organisms of any kind present in milk when being formed?

This question must certainly be answered in the negative so far as healthy cows are concerned. No doubt numbers of micro-organisms are introduced into the respiratory as well

as the digestive organs with every breath of air, and every mouthful of food. The possibility is not even excluded of micro-organisms entering the orifice of the teat and working their way up into the milk cistern during the interval from one milking to the next; but the healthy animal tissue has never been found to contain micro-organisms, and animal tissue forms the chief material for the formation of milk. During the period of lactation there is a constant and very active degeneration of certain cells in the cow's udder going on, the degenerated cells being replaced by new ones, which soon undergo the same process of decomposition, the products of which are the component parts of milk. The largest portion of the solids in milk are derived from this source, while most of the water and most probably part of the solids are transudated from the blood.

In accordance with this view of the formation of milk, it must be declared impossible that the latter should contain micro-organisms when being formed. The only way in which they enter the milk is from outside, after it has been drawn from the udder.

This hypothetical view is fully supported by practical experience. Lister and other investigators first tried to prove whether the ferment which causes lactic fermentation was regularly present in absolutely uncontaminated milk. They failed in their early experiments to get a milk which would not curdle, or decompose in some other way, after it had been kept for a time under conditions which effectually prevented germs from entering the milk. They succeeded, however, when by experience they had learned to avoid all those circumstances which could interfere with the experiments and obscure the results. Similar experiments, but on a much larger scale, and with the practical purpose in view of keeping milk in a pure and absolutely unaltered state for some length of time, were made by O. Pohl of Liverpool. Pohl's method of preserving milk, for which he has taken out a patent, is mainly as follows:

Clean glass bottles, closed with a stopper made of compressed asbestos, are placed in a suitable room and annealed in order to completely destroy all organic life. On cooling, the air in the bottles is contracted and supplemented by air which is filtered by passing through the porous asbestos stopper, and thus freed from all impurities, inorganic and organic. When the bottle is to be used, the stopper is removed and replaced by a funnel with a bent tube, to prevent froth entering the bottle. It is best to heat the funnel before use. The milk is then drawn from the udder of the cow directly into the sterilised bottle, which is closed with the asbestos stopper as soon as it is filled.

By thus avoiding the use of other vessels, and assuming that proper care is taken that the cows' udders are quite clean, and

that the milking is done in a pure atmosphere, the danger of organisms entering the milk is reduced to a minimum. Milk treated in the manner described has been found to keep fresh and sweet for several weeks. If this system must be pronounced as unworkable in the daily practice of dairying, it no doubt gives valuable hints which ought to receive careful consideration. The utmost cleanliness with regard to the cows, and more especially their udders, as well as all the vessels with which the milk comes in contact, is of the greatest importance in keeping micro-organisms in check. It is a precaution deserving full attention not to collect the first stripping from each teat, but to milk it into the hollow of the hand, and taste it, as is done in some dairy districts. All vessels should be cleansed with boiling water, and finally, if possible, a jet of steam directed into them.

To avoid the milk coming into contact with the air is a practical impossibility, and even under Pohl's patent system it is not altogether excluded. The first care then must be to keep the air as free from impurities as possible. As, however, even in the purest air at our disposal, micro-organisms are present, the question arises, how can their action be limited, or prevented?

Destroying ferments, or at least preventing their development, is the object of all the different processes of disinfection and preservation. These can be divided into two groups—those which are based on the addition of certain chemical disinfectants, and those in which the application of low or high temperatures is relied upon.

Employing chemicals for the purpose of preserving milk is, upon the whole, objectionable. The most powerful disinfectants, containing acids and compounds of the heavy metals, are absolutely excluded because of their decomposing action on milk, and their effect upon the human body. Others, such as thymol and benzoic acid, are not suitable on account of their imparting to milk an unusual smell, or as giving a taste, e.g. salicylic acid, when added in quantities sufficient to have any appreciable preservative effect.

Perhaps the least objectionable of all preservatives recommended for milk is boracic acid and its various preparations, the effect of the latter depending on, and being equivalent to, the quantity of the pure acid they contain. But even the addition of boracic acid is of comparatively little use, and at the same time cannot be considered altogether harmless. The quantity of the acid which can be added to milk without impairing its taste is relatively small, though large enough to interfere with the assimilation of food in the human system when continuously taken. Moreover, the addition of the preservatives in question

has not the effect of destroying the fermentative organisms, but simply of diminishing or retarding their development, and their action will be seen after a longer or shorter period.

The system most recommended—and a more reliable one than the addition of chemical preservatives, which have been shown to alter the composition of the milk—is the process of subjecting the latter to temperatures which are unsuitable to organic life. Although the temperatures suitable for the development of micro-organisms are for the different varieties not exactly the same, they do not vary very much, so far as they are known at present, and are very close to the temperature at which milk leaves the cow. It is, then, of the greatest importance that the period at which freshly-drawn milk is kept at this most dangerous temperature should be shortened as much as possible.

The easiest way to accomplish this in practice will be found in cooling down the milk by running it over a refrigerator. The lower the temperature which can be reached and maintained the better, and the longer the milk will keep. At the temperature of or near freezing point the development of micro-organisms appears to cease altogether, so that milk at this temperature may be kept almost an indefinite length of time.

This is a point of considerable importance, and has been taken advantage of by some of our large steamship companies. Instead of being compelled, as they were formerly, to take on board cows in milk in order that they might be in a position to supply infants, invalids, and others desirous of having fresh milk, they now provide themselves before leaving port with a supply of fresh milk large enough to last the whole voyage, a quantity sufficient for a day's consumption being placed in separate cans, and these cans stored in a room kept at a temperature considerably below freezing point. The milk being transformed to ice keeps perfectly fresh for months.

If the object in view be to preserve fresh milk for a few days only, a temperature not higher than 45° Fahr. serves the purpose admirably. The last mentioned, and most probably even much lower temperatures, do not, however, destroy micro-organisms and still less their spores, their development only being more or less impaired by the action of the cold.

The other extreme of temperature, viz., heat, produces a similar effect. Milk can be preserved for days by simply boiling it for a few minutes repeatedly, and at proper intervals, say once a day. But even raising its temperature for a moment to 165° Fahr. will have a marked effect with regard to its keeping qualities. If heating to this temperature is repeated at intervals, the effect is better still, and if in addition proper precautions are taken to carry out the heating process in a way by which fresh germs are

prevented from entering the milk, the latter can be completely sterilized at this comparatively low temperature.

At the temperature of boiling water (212° Fahr.), and keeping the receptacles containing the milk tightly closed, the process of sterilization may be completed in one operation, and is therefore less troublesome. A greater security still is obtained by heating under pressure to 230° Fahr.

The complete sterilization of milk by heating it repeatedly to 165° Fahr., under proper precautions, has been accomplished, but with small quantities only, and in an experimental way. The carrying of this out on a large scale would be beset with many obstacles and great difficulties. The experiments occupied a period of five days, during which time the small samples of milk were heated for one hour daily. The reason why the repeated heating at intervals to a lower temperature has the same effect as once raising the temperature to a higher degree (always assuming that the introduction of germs is excluded) is easily explained. The temperature of 165° Fahr. is, generally speaking, sufficient to kill developed micro-organisms, but not their spores. If, therefore, the milk after heating is allowed to cool down again, there is the chance given to the intact spores to germinate and to be killed by the following heating.

Thus, repeated heating at intervals will free the milk gradually from all organic life. The spores which will resist lower temperature succumb to higher degrees of heat, and if exposed sufficiently long are killed outright. This is the case, at least, with the organisms of lactic fermentation, so that it is a comparatively easy task to prevent milk getting sour for a long time. Not infrequently, however, a preserved milk which shows no sign of turning sour possesses a bitter taste, proving that the organisms which are able to transform proteïds into peptones have survived.

Butter.

If with regard to the action of micro-organisms on milk much remains to be cleared up, we must admit that with reference to butter very little has, so far, been done. What we know for certain is that butter is subjected to certain decompositions, as shown by a more or less marked change in its taste; but how these decompositions are brought about and in what they actually consist we are, with our present knowledge on the subject, for the most part unable to say. With the exception of very slight traces of colouring matter (annatto) in the case of coloured, and a quantity of common salt in the case of salt butter, genuine butter contains nothing but compounds which are also present in milk. The percentage of fat is of course vastly

increased, and on an average amounts to 85 per cent. In the case of butter to which no salt has been added, from 13 to 14 out of the remaining 15 per cent. is water, and from 1 to 2 per cent. is made up by the other constituents of milk, viz., proteïds, milk-sugar, and ash. Butter made of sour material generally contains rather a large amount of casein, which is present in the precipitated state, and little or no milk-sugar, but in place of it lactic acid; while salt butter contains from 1 to 5 per cent. of common salt and a corresponding lower percentage of fat.

Pure butter-fat, obtained from butter by melting the latter and clarifying the fat by filtration, can be kept for a considerable time unchanged and undecomposed, provided it be protected from the action of air and light. Even one of these two agents alone will not readily act upon pure butter-fat, but under their combined action the fat attains a tallowy taste and appearance in a very short time, and when subjected to a chemical analysis is found to have undergone material changes in its composition. Other organic bodies which are in a state of decomposition will, when intimately mixed with butter-fat, also have the effect of causing its decomposition to a greater or less degree.

Butter is such an intimate mixture of butter-fat and decomposable organic matter, that decompositions occurring in the butter-milk left in the butter, even if present in very small proportion only, will extend themselves to the butter-fat. Indeed, it may be said that the fat has been already affected before the butter is made, in case sour milk or sour (ripened) cream formed the material for churning. The commonly called "nutty flavour" of butter made of slightly sour material must be assigned to traces of compounds formed by a slight decomposition of the fat, and as this flavour is not noticed with fresh butter made of sweet material, there is good reason to assume that the decomposition of the fat is the consequence of decompositions of other organic constituents of the butter. How these decompositions are caused by micro-organisms we have seen in the preceding pages. If not directly, certainly indirectly, we must assign decompositions occurring in butter to the same causes.

As a matter of fact, it was found that the butter-milk, in a butter made from sour cream and declared to be of bad keeping quality, contained a great number of micro-organisms, which are described as globular in shape and lively in motion; while in the butter-milk of butter made from sweet cream and pronounced as of good quality these organisms were not present. The two kinds of butter were melted at a low temperature, and the separated scum of both mixed with sterilized milk, when it was observed that the scum of the former, containing the micro-

organisms, soon caused the coagulation of the milk, while the milk mixed with the scum of the latter remained apparently unchanged for ten days. It does not appear that the micro-organisms, which must be supposed to have played the prominent part in causing the decomposition of butter, were investigated any further, and it is therefore impossible to identify them with any of those micro-organisms previously described.

According to what has been said above, we must assume that the keeping quality of butter depends, if not entirely, certainly in the first place upon the state of the contained butter-milk. It might, then, appear advisable to remove all the butter-milk ; but this is not only a practical impossibility, but it would also deprive the product of its proper character. It is, however, certainly desirable to expel as much of the butter-milk, by washing and kneading the butter, as can be done without injuring its quality and deteriorating its value, and further to take precautions that what butter-milk is left is present in a state in which it can do the least injury. This is the case, for instance, if sweet material is churned. Circumstances are less favourable with regard to sour churning material ; but there are different degrees of acidity, which have great influence on the keeping quality of the butter. As long as the milk or cream to be churned is only slightly sour, there will be no difficulty in breaking up the gelatinous casein into particles of the minutest size ; but if the material has been allowed to reach a high degree of acidity, the casein will partially have been precipitated in small lumps, which are not broken by the churning process, and when included in the butter cannot be removed by washing or working, and form a centre of decomposition which will soon set in and progress rapidly.

One mode of preservation, viz., destroying micro-organisms by the application of heat, is entirely excluded in the case of butter. Low temperatures have a very good effect, but their application meets with great difficulty in practice. There is one way, however, left, which in a great number of cases answers the purpose exceedingly well, and is in no way objectionable, viz., to make use of the preservative qualities of common salt. Butter salt should if possible consist of fine crystals, congregated in little pyramids or funnels. Such salt, when worked into fresh-churned butter, easily dissolves in the buttermilk, gathering the latter in drops large enough to run off, thus removing a large proportion of buttermilk, and guarding the remaining portion against further decomposition. It may be observed here that it has been found that salicylic acid causes butter to acquire a tallowy taste.

Cheese.

All that has been said in the previous pages points to one thing, viz., the desirableness of preventing the occurrence of chemical changes in milk and butter. The safest plan to avoid those changes would be to remove their original cause, and as we have recognised the causes of the most prominent alterations in micro-organisms, the latter, with the decompositions and deteriorations which they involve, should be kept out as much as possible. That in the ordinary course of things we cannot shut out micro-organisms altogether has been pointed out; but what we can do is to keep them in check to some extent, avoid some, and counterbalance the action of others.

With cheese the case is widely different. Cheese is a product of fermentation from beginning to end. Not only is it a fermentative process by which the casein of milk is coagulated, and thereby separated from the watery part, but those changes which are comprised under the term ripening, and which virtually consist in transforming curd into cheese, are decompositions brought about by micro-organisms, i.e., true fermentations.

In cheese-making, then, the exclusion or destruction of micro-organisms would be entirely out of place: in fact, could it be done, it would make the manufacture of cheeses as we know them an impossibility.

It must not be inferred from this that the more micro-organisms there are present in milk or curd the better suited it is for cheese-making, and the easier is the manufacture. We have seen that not all micro-organisms are able to develop under similar conditions, and in consequence do not bring about the same decompositions in similar media. We have further seen how a particular kind of micro-organism induces a certain fermentation with definite products, while other kinds give rise to other fermentations as recognised by the production of totally different compounds. Curd, then, though like milk, apparently a good soil for the majority of micro-organisms, is undoubtedly better suited to some than to others. The former will, under favourable conditions, develop and crowd out the latter. By changing the conditions they may become more favourable to another kind again, and the operator then has it, to some extent, in his power, by his mode of operation, to encourage the development of one or of another kind of micro-organism, and thereby produce cheeses of very different character. If we select from handbooks on cheese-making, in which hundreds of various kinds of cheeses are enumerated, those kinds only which are of a well-defined and uni-

versally recognised, and among themselves clearly distinguished character, and if we take it for granted, as we have good reason to do, that their characteristic qualities, especially with regard to flavour, are the consequences of the action of different kinds of micro-organisms, the number of these micro-organisms would be by no means small.

The question then arises, are all these micro-organisms present everywhere, so that the manufacture of a special kind of cheese, with all its characteristic qualities, is possible at any place, provided the conditions favourable to the development of the micro-organism peculiar to the cheese in question are well understood? This question has been negatived, not only by abstract theory, but by practical experience. It has been contended, that with due skill and knowledge cheeses similar in many respects to Stilton, Camembert, Neufchatel, and the like, can be made anywhere, but that they will be imitations only, distinguished from the genuine article in some particular point of flavour, as long as they are made outside the district in which the manufacture has been carried on for ages as a specialty.

The explanation given is this: in a district in which a certain kind of cheese, requiring for its production the action of a special kind of micro-organism, has been carried on for a great number of years, it is to be expected that such micro-organisms will be present in abundance, while in other districts they may be very rare, or even entirely absent. The success in making a foreign cheese would depend then not only on the introduction of the peculiar mode of operation, but also upon the importation of a particular kind of ferment or ferments. It is obvious that with different kinds of cheese wide differences must exist in this respect. While it may be an easy matter to make a particular kind of cheese at any place because it only requires ferments, which are widely spread and met with anywhere, it may be a matter of impossibility in some localities to produce the cheeses whose characteristic qualities are caused by rare organisms. The products of fermentation had long been known before anything was discovered about the cause. To bring the causes of fermentation home to micro-organisms was a great step accomplished, after many difficulties had been overcome; but far more difficult is it to identify the undoubtedly vast number of the special kinds of micro-organisms, and recognise the fermentative decompositions which each particular kind is able to produce in different kinds of media.

In the case of cheese, research is surrounded with unusual difficulties. The chemical constitution of the nitrogenous matter forming the chief component part of cheese is not yet known, nor are all the bodies formed from its decomposition under

various circumstances. As to all the decompositions the butter-fat contained in the cheese is able to undergo, our knowledge is also far from complete. Moreover, smell and taste are so much more sensitive than all our chemical re-agents, that the quantities of products of certain fermentative actions may be quite large enough to give the cheese in which they are present a distinct character, and yet be far too small to allow of their chemical recognition, definition, and quantitative determination.

Considering this, and bearing in mind that the study of micro-organisms and their action is still in its infancy, much definite knowledge can scarcely be expected. The most important systematic investigation on the subject is that made by M. Duclaux on the manufacture and ripening of Cantal cheese. This cheese is said to contain ten or more micro-organisms, of which six are supposed to be of especial importance. There is an alcoholic ferment, a lactic ferment, a butyric ferment, and a ferment acting upon the casein and forming alkaline nitrogenous compounds of simple composition. These four ferments have to perform well-defined functions, but of the greatest importance are the remaining two.

The one is described as a vibrio forming chains, which exhibit an undulating motion ; the vibrio prefers a temperature of 75° to 85° Fahr., and forms spores. When introduced into milk the vibrio causes the development of carbonic acid and hydrogen gas. Sugar and fat are not acted upon, but casein is transformed into an albuminous substance soluble in water, even in the presence of acid. At the same time small quantities of butyric acid and ammonium butyrate are produced. When in the manufacture of the cheese the curd is cut up in order to get rid of the whey, the vibrio causes the parts of the coagulum to stick together and form a solid mass of cheese ; the presence of the ferment is therefore desired in the whey. If, however, it enters into the coagulum itself, it will give rise to the formation of gas which heaves the cheese, and also butyric acid and its compounds, which will spoil the taste. The vibrio resists a temperature of 170° Fahr. ; the spores resist a temperature even above boiling-point.

The other ferment is a bacillus, growing in the shape of thin threads on the surface of liquids, and shorter and thicker if submerged. Like the previously described ferment, it acts upon the casein, transforming it into a soluble substance, which is neither precipitated by acids nor coagulated by boiling. Besides this nitrogenous body acetic acid is formed, as well as a substance of an intensely bitter taste, which makes the ferment highly objectionable. As this bacillus resists the temperature of boiling water, its destruction is a matter of considerable difficulty.

These two instances of a close investigation are sufficient to show the variety of questions which have to be taken into consideration, and also the difficulty of carrying out researches of this nature. When speaking of the micro-organisms of butyric fermentation, we have mentioned that, under the influence of this ferment, casein precipitated in the first instance is gradually dissolved again. As the butyric ferment never seems to be absent in cheese, there is full reason to assume that such ferment takes a prominent part in its ripening. We are also acquainted with ferments acting upon albuminoids so as to split them up into nitrogenous compounds of a less complex nature and alkaline reaction, ammonia being the simplest of the series. This kind of fermentation is also going on in cheese, for salts of ammonia never fail to be present in ripened cheese. That under certain circumstances which are not yet defined, there may be found amongst the products of decomposition of albuminoids bodies belonging to the class of ptomaines, i.e., compounds of a highly poisonous character, has been pointed out in a paper by the late Dr. Voelcker published in this 'Journal' (vol. xxiii. 1862), and more recently in America by Dr. Vaughan. Ptomaines are also considered products of an advanced decomposition (putrefaction) caused by micro-organisms.

With the presence in cheese of larger organisms belonging to the vegetable kingdom, viz., *moulds*, we are much more familiar; but it can scarcely be said that our knowledge of the way in which they act in the process of cheese-ripening is more thorough and complete than in the previous case. Roquefort is a cheese presumably made entirely from ewes' milk in a very limited district of France. This cheese contains, as is very well known, veins of green mould, and so much is it thought necessary that this mould should be present that the latter is specially prepared. It is grown upon bread made of wheat or barley and incorporated into the curd of which the cheese is formed. The growth of the mould is further encouraged by piercing the cheeses at regular intervals whilst they are kept to ripen, and thereby admitting air to the interior. The development of other organisms is at the same time kept back as much as possible by storing the cheeses in cellars, or caves hewn out of the rock, the temperature being kept at from 40° to 50° Fahr. This temperature is unfavourable to the growth of the majority of micro-organisms, but does not interfere with the growth of the mould. Roquefort has a very characteristic flavour, as have Stilton and Gorgonzola, also cheeses which contain the green mould. How far the fermentations going on in these cheeses are similar or identical has not yet been ascertained.

There are other cheeses which we are wont to see infested with particular kinds of mould, though as a covering on the outside only. We expect to see white mould on one, red on another, and grey on a third kind of cheese. With some cheeses the growth of mould changes during the process of ripening, as clearly indicated by distinct changes of colour.

The manufacturer judges by the successive appearance of different moulds the regular progress of the ripening process, and the stage the cheese is in. Whether these moulds, appearing on the outside of cheeses, have any influence on the ripening, or whether they are only a kind of indicator that the cheese has reached a certain stage, and is of normal quality, is a question which we have never heard raised. We are, however, of opinion that the quality of the cheese is little if at all affected by the outside fungoid growths, and that the latter have no importance beyond showing that certain changes must have taken place in the cheese, as they will appear only under certain conditions. A certain action on the cheese cannot be denied, such as saponifying fat, forming ammonia salts of the fatty acids, and liberating glycerine; but action of this kind will scarcely affect more than the rind of the cheese.

Greatly desired as are certain fungoid growths on some cheeses, others are as much dreaded and despised. A micro-organism, for instance, resembling yeast in its shape and development, infesting certain kinds of cheese, and producing more and more spreading spots of deep black colour, reduces the value of the cheese to a great extent, if it does not make it altogether unsaleable, on account of its affecting the taste.

Conclusion.

In these days science progresses at such a pace that it is utterly impossible for the majority of men to follow its rapid advances step by step. One must make a halt every now and again to look back at and sum up what has been done in a special branch during a limited period which has passed. In the preceding pages the endeavour has been to give such a review with regard to the limited field indicated by the title of this article. The writer has felt the great difficulty of being brief, and at the same time clear, on subjects which can scarcely be regarded as generally familiar, the more so as these subjects are up to the present very insufficiently investigated. It should be kept in mind, that what was thought correct and true yesterday may be found to be false to-day; and what stand as isolated facts to-day may form part of an established system to-morrow.

XVII.—*Experiments on Ensilage conducted at Crawley Mill Farm, Woburn*, 1886–7. By Dr. J. Augustus Voelcker, B.A., B.Sc., Consulting Chemist to the Society.

The following is an account of the third set of experiments on ensilage conducted at Woburn, these being a continuation of the previous ones made during the winters of 1884–5 and 1885–6, reports of which have already appeared in this Journal.*

Whereas in the previous experiments the special object had been to determine the value of grass silage as compared with a mixed food of roots and hay, in the present instance an endeavour was made to arrive at the value of grass made into hay as against that of the same grass cut green and converted into silage. For this purpose it was essential to take into account, not only the actual weight of grass used, but also the acreage of ground cleared. The field chosen was one on Birchmoor Farm, Woburn, belonging to Mr. Edward Blundell, and was the same field from which the grass used in the previous year's experiments had been taken. The herbage, though not of really fine quality, was very fair in character. In order to institute an accurate comparison, 5½ acres of ground were carefully measured out, and the grass was only cut as it was wanted for carting, not being allowed to lie in the field any length of time. Two carts going side by side were filled simultaneously, and then taken to be weighed. After weighing the contents, one cart went to the silo into which the grass was to be filled, and the other went to a meadow where the grass was spread and left for haying.

My experience of previous years had shown me the absolute necessity of the utmost care in sampling, and accordingly each cartload was sampled. A lad, following the cart, drew from the grass, as it was being thrown up, handfuls which were at once put in a sack, then mixed and weighed in the field. Taking these precautions, the silo was filled, and a rick of hay was made, each with grass taken as nearly as possible under the same conditions. On July 2, 1886, fourteen loads of grass, weighing 10 tons 11 cwt. 1 qr. 17 lbs., were put into the silo, and at the end of the day covered with boards and weighted to some extent. During the night the material sank considerably, and next day five loads more were added, weighing 4 tons 1 cwt. 1 qr. 3 lbs., making a total of 14 tons 12 cwt. 2 qrs. 20 lbs. of grass put into the silo. The grass was trodden down by four men, and then covered over with boards and weighted with boxes of stones as in previous experiments. The silage was accordingly intended

* 'Journal,' 2nd Series, vol. xxii. p. 483.

to be of the character generally termed "sour." Simultaneously 14 loads of grass, weighing 11 tons 10 cwt. 3 qrs. 15 lbs., had been spread out in the meadow on July 2 for haying, and five loads more, weighing 3 tons 16 cwt. 2 qrs. 15 lbs., were added on July 3, making a total of 15 tons 7 cwt. 2 qrs. 2 lbs. of grass for haying. The weather, which had been fine throughout, continued so up to July 5, when the hay was made and weighed. There were then 5 tons 4 cwt. 0 qr. 1 lb. of hay, which were made into a rick.

The details of the construction, size, &c., of the silos have been given in a former paper,* and it will be sufficient here to say that the silo used was one of six formed out of an old barn by the building up of brick division walls, the sides of the silo and the floor being thoroughly well cemented. The silo was 6 ft. 2½ in. wide, 20 ft. 6 in. in horizontal depth, and 16 feet high. The front was bricked to a height of about 7 feet, the material being filled in from carts over the top of this front. Above this could be fixed wooden boards when required.

The pressure was given by stones in strong elm boxes, and amounted to 112 lbs. per square foot. The silo was unprovided with any drain. Temperatures were taken in different parts at depths of 1, 2, and 4 feet from the surface. The height of the grass immediately after the filling was completed was 12 ft. 6 in. On opening the silo on December 16, 1886, the contents were found to have sunk to 7 ft. 6 in., only reaching to the top of the first board above the brick frontage.

The question of how to sample the silage was one of the greatest importance. Unless this sampling be done with the utmost care, altogether fallacious results are almost sure to be obtained. My experiences of the year before had shown me only too clearly that even by drawing a large number of samples from different portions of the mass of silage, an experimenter might readily fail to get accurate information as to the composition of the entire contents of a silo, and of the loss consequent on ensiling. I therefore adopted this year the following plan for ensuring that the samples drawn should be really representative ones of the whole bulk:—

The silo was just over 20 feet long, and so I divided off the contents into four blocks, each about 5 feet in length; as the middle of the block was being reached, a section, or rather "boring," of the whole block was cut out from top to bottom. This boring was collected in a bag and carefully but rapidly mixed together on a sheet, the quantity reduced by frequent division, and ultimately a representative sample drawn, which was taken for analysis.

From July 3 until December 16 (when the silo was

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* 'Journal,' vol. xxii. p. 484.

opened), the highest temperature reached was 94° Fahr., and on the latter date the temperatures were: at 1 ft. depth, 50° Fahr.; at 2 ft., 49° Fahr.; and at 4 ft. also 49° Fahr.

RECORD of TEMPERATURES in SILO. 1886.

Date.	Temperature of Barn.	At depth of 2 ft. (Front.)	At depth of 4 ft. (Centre)	At depth of 1 ft. (Back.)
1886.	° F.	° F.	° F.	° F.
July 3 ..	75	..	85	86
„ 9 ..	..	..	..	75
„ 10 ..	63	86	92	83
„ 11 ..	64	88	94	82
„ 13 ..	64	87	92	84
„ 15 ..	61	86	90	81
„ 18 ..	70	85	90	80
„ 20 ..	69	85	88	80
„ 22 ..	69	84	86	80
„ 31 ..	62	79	83	75
Aug. 7 ..	69	78	79	75
„ 13 ..	64	76	77	75
„ 25 ..	67	73	74	73
Sept. 7 ..	65	71	71	72
„ 17 ..	57	68	69	69
Oct. 2 ..	62	65	66	65
„ 18 ..	53	62	63	62
„ 26 ..	47	60	62	58
Nov. 11 ..	46	60	57	56
Dec. 1 ..	40	51	52	51
„ 16 ..	41	50	49	49

On removing the boards, the top surface was found to be moulded to a depth of 4 inches. At the sides there was at first also a little waste, caused principally by the boarded doorway. At a depth of 1 foot from the surface, at the sides the silage was free from waste. The silage itself was extremely good and well made: a thermometer inserted into the material registered 40° Fahr. when taken out of the silo. The depth of good silage was 7 ft. 4 in. It was universally allowed that the silage of the previous experiments had been of a good character and well made, but in this the third year there was further improvement, and the waste was still more reduced in quantity.

For the feeding experiment, twelve Hereford bullocks were selected, which had been purchased at Northampton fair in November. They were about 2½ years old and cost 16*l.* 2*s.* 6*d.* apiece. As in the previous experiments, cake and meal were given as additional foods, each bullock receiving daily—

3 lbs. decorticated cotton-cake.
5 lbs. maize-meal.

One set had, in addition, silage and water, and the other hay

and water, all *ad libitum*, but the quantities given were duly weighed out and recorded. It was felt to be interesting to watch how the bullocks fed upon dry food and water only would fare, as compared with those receiving a succulent food. The feeding-boxes were able to accommodate eight bullocks, and there was also available for use a shed holding four others. The following arrangement of the trial was accordingly made:—

4 bullocks in boxes 2 „ in shed — 6 bullocks.	receiving daily per head ..	3 lbs. decorticated cotton-cake, 5 lbs. maize-meal, With Hay *ad libitum*, and water *ad libitum*.

versus

4 bullocks in boxes 2 „ in shed — 6 bullocks.	receiving daily per head ..	3 lbs. decorticated cotton-cake, 5 lbs. maize-meal, With Silage *ad libitum*, and water *ad libitum*.

The bullocks were weighed on December 16, 1886, and the experiment commenced.

Weights of Bullocks at Commencement of Experiment, Dec. 16, 1886.

To receive Hay. Bullock.	cwts.	qrs.	lbs.	*To receive Silage.* Bullock.	cwts.	qrs.	lbs.
In Boxes.							
No. 1	10	0	3	No. 5	10	2	14
No. 2	9	1	7	No. 6	9	2	0
No. 3	9	0	3	No. 7	9	1	21
No. 4	11	0	18	No. 8	10	0	0
	39	2	3		39	2	7
In Shed.							
No. 9	10	1	23	No. 11	11	0	2
No. 10	10	1	13	No. 12	9	3	11
	20	3	8		20	3	13
Total of 6 bullocks ..	60	1	11	Total of 6 bullocks ..	60	1	20

The bullocks took at once to their respective foods, and indeed throughout the whole experiment they continued to feed very well, none of them showing any sign of illness whatever, or indisposition to eat their foods. The silage bullocks commenced with 38 lbs. per head daily of silage, which rapidly increased to 45 lbs. and then to 50 lbs. and 51 lbs. About 20 lbs. was the amount of hay consumed at commencement, and this quantity approximately was maintained throughout.

During the first fortnight it was noted that the bullocks in the shed, whether receiving hay or silage, drank nearly double

the amount of water that those in the boxes did; after that, the silage ones in the shed took about the same quantity of water as those in the boxes, but, to the close of the experiment, the bullocks in the shed eating hay took more water than those in the boxes. The reason of this was not clear, for the temperature of the shed was exactly the same as that of the boxes, and the silage and hay for the two sets were taken each from one lot and simultaneously. After 54 days the bullocks were weighed with the following results:—

WEIGHTS OF BULLOCKS ON FEB. 8, 1887, AFTER 54 DAYS' FEEDING.

Receiving Hay.				*Receiving Silage.*			
IN BOXES.							
Bullock.	cwts.	qrs.	lbs.	Bullock.	cwts.	qrs.	lbs.
No. 1	11	0	7	No. 5	12	0	0
No. 2	10	1	21	No. 6	10	1	0
No. 3	10	0	12	No. 7	11	0	0
No. 4	12	1	5	No. 8	11	0	19
IN SHED.							
No. 9	11	3	0	No. 11	11	1	7
No. 10	11	1	7	No. 12	10	3	0
Total of 6 bullocks on Feb. 8	66	3	24	Total of 6 bullocks on Feb. 8	66	1	26
Total on Dec. 16 ..	60	1	11	Total on Dec. 16 ..	60	1	20
Total increase of 6 bullocks in 54 days ..	6	2	13	Total increase of 6 bullocks in 54 days ..	6	0	6
Gain per head daily ..	2·3 lbs.			Gain per head daily ..	2·1 lbs.		

During this period, in addition to the daily allowance of 3 lbs. decorticated cotton cake and 5 lbs. maize-meal, the average daily amount of food consumed per head had been:—

BULLOCKS RECEIVING HAY.			BULLOCKS RECEIVING SILAGE.		
	Boxes.	Shed.		Boxes.	Shed.
	lbs.	lbs.		lbs.	lbs.
Hay	20	21·4	Silage	49·0	49·6
Water	61	82·4	Water	38·7	44·3

The experiment was continued for another 30 days, during which the silage bullocks took as much as 53 lbs. of silage per head daily, the other foods remaining much as in the first period. On March 10, 1887, the beasts were again weighed.

Weights of Bullocks on March 10, 1887.

Receiving Hay. | *Receiving Silage.*

In Boxes.

Bullock.	cwts.	qrs.	lbs.	Bullock.	cwts.	qrs.	lbs.
No. 1	11	0	9	No. 5	12	1	7
No. 2	11	1	14	No. 6	10	2	8
No. 3	10	2	13	No. 7	11	1	19
No. 4	12	2	22	No. 8	11	1	21
In Shed.							
No. 9	11	3	15	No. 11	12	1	12
No. 10	11	2	3	No. 12	11	1	0
Total of 6 bullocks on March 10	69	0	20	Total of 6 bullocks on March 10	69	1	11
Total on Feb. 8 ..	66	3	24	Total on Feb. 8 ..	66	1	26
Total increase of 6 bullocks in 30 days ..	2	0	24	Total increase of 6 bullocks in 30 days ..	2	3	13
Gain per head daily ..	1·4 lbs			Gain per head daily ..	1·8 lbs.		

The following Table represents the increase of weight during the whole time of experiment, viz., 84 days:—

Increase of Weight during entire period of Experiment, from December 16, 1886, to March 10, 1887 (84 days).

	Receiving Hay.	Receiving Silage.
	cwts. qrs. lbs.	cwts. qrs. lbs.
Total weight of 6 bullocks, March 10, 1887 ..	69 0 20	69 1 11
,, ,, ,, Dec. 16, 1886	60 1 11	60 1 20
Total gain in 84 days	8 3 9	8 3 19
,, ,, ,, = lbs...	989 lbs.	999 lbs.
Gain per head daily	1·96 lbs.	1·98 lbs.

In the above the bullocks, whether in the boxes or in the shed, have been taken as forming two sets only. If the bullocks in the boxes and those in the shed are considered separately, the average gain per head daily will be:—

	Receiving Hay.	Receiving Silage.
Bullocks in Boxes	$2\frac{1}{12}$ lbs.	$2\frac{1}{17}$ lbs.
,, ,, Shed	$1\frac{3}{4}$ lbs.	$1\frac{5}{6}$ lbs.

During the experiment the total quantities of hay and silage consumed were:—

			Average per head, Daily.
		Tons cwts. qrs. lbs.	lbs.
By 6 Bullocks receiving Hay ..	Hay	4 11 2 6¾	20·3
	Water	15 18 1 24	70·7
			91·0
By 6 Bullocks receiving Silage ..	Silage	11 9 3 5½	51·0
	Water	9 0 3 0	40·1
			91·1

The results of weighing come out singularly alike, not only with regard to the gain pel head, but also in the similarity of the daily totals of silage and water, in the one case, and of hay and water in the other.

The result is in some ways remarkable, as it would not have been generally expected that a diet of perfectly dry food, such as was given in the hay, cake, and meal, with water supplied separately, would give a result so nearly equal to that obtained by the use of succulent food in addition to the cake and meal. The hay having by March 10, 1887, been all consumed, the experiment was closed; but a little of the silage still remaining, the bullocks were kept on it for a few days longer, while for the other set a fresh quantity of hay taken from off the same field was fortunately procurable. When the silage also was finished, the bullocks were again weighed previous to being slaughtered, and both live and dead weights were recorded in several cases.

Date.	Bullocks.	Food.	Unfasted Live-weight = 14 lbs. st.	Carcass-weight = 8 lbs. stones.	Percentage of Offal.
1887			cwts. qrs. lbs. st. lbs.	st. lbs.	
March 29	1	Hay	11 0 5 = 88 5	84 7	45·11
„	2	„	11 2 0 = 92 0	88 5	44·95
„	3	„	10 2 21 = 85 7	86 7	46·95
„	4	„	13 0 0 = 104 0	103 5	43·06
March 23	5	Silage	12 1 14 = 99 0	95 0	45·17
„	6	„	10 3 0 = 86 0	84 7	43·60
„	7	„	11 1 14 = 91 0	88 3	44·51
March 21	8	„	11 1 22 = 91 8	91 6	42·75

This accordingly gives :—	Of Hay-fed Beasts.	Of Silage-fed Beasts.
Average percentage of offal	43·76	44·01

Notes on Contents of Silo.

The material was removed from the silo in slices taken from top to bottom. As already mentioned, the whole contents were divided into four blocks, each of which was sampled, a sample being cut from top to bottom. A record was kept of the weights of material removed, and also of what portion was good and what was unfit for use. Further, the exact weights of food given to the beasts used in the experiment were recorded. As the silage was gradually cut into and removed, it was found that the mould on the top surface varied from 3 inches to 5 inches in depth; at a depth of 6 inches from the surface there was from 1 to 2 inches of waste at the sides. Eight inches down, however, there was no waste at all.

At the back and in the corners there was some little waste, due to the impossibility of compressing the grass in these parts so perfectly. The lowest foot of silage was considerably wetter than that above, but remained perfectly good to within half-an-inch of the bottom. The last quarter-inch was very wet, and had a decidedly strong smell; this the beasts would not eat. But the whole waste was, it will be noticed, wonderfully small, showing that experience in silage-making has contributed greatly to improvement in this direction.

This year, as last, proved that in silage-making there is really no need of special drains to silos if extreme pressure be not used, and that the more perfectly the grass is kept from the intrusion of air the better will be the result; also that there is less waste when cemented brick is in contact with the silage than when wooden boards are used to close it in.

A cubic foot of the silage weighed $24\frac{1}{2}$ lbs.

In the Table on page 413 are given the respective losses of the several constituents, by the process of ensiling and the making of hay respectively. The total loss due to fermentation, evaporation, &c., in making the silage was 7·29 per cent. on the fresh grass. Of this, $3\frac{1}{4}$ per cent. consisted of water. The loss of total nitrogen when, as here, no drainage was allowed to flow away, is very slight; but the nitrogenous bodies have undergone considerable change from the albuminoid to the non-albuminoid condition. The woody fibre, as indeed the whole of the fibre, has been diminished, insoluble albuminoids are lessened, and the soluble albuminoids increased. In the hay, the nitrogen has undergone but little change. These are the main features shown in the Table.

CHEMICAL COMPOSITION *of the* GRASS, SILAGE *and* HAY; *quantity and composition of the Grass put into Silo, of the Silage produced, of the Grass used for Hay, and of the Hay made.*

CHEMICAL COMPOSITION of GRASS used for SILO and HAY.

	First day's Filling, July 2nd.		Average.	Second day's Filling, July 3rd.		Average.
	First Analysis.	Second Analysis.		First Analysis.	Second Analysis.	
Water	69·20	69·34	69·27	73·48	73·86	73·67
Soluble albuminoids ..	·13	·11	·12	·24	·18	·21
Insoluble albuminoids	2·41	2·30	2·35	1·95	1·93	1·94
Digestible fibre	10·62	10·39	10·51	8·64	8·64	8·64
Woody fibre	8·37	8·53	8·45	7·13	7·59	7·36
Soluble carbohydrates, chlorophyll, &c. ..	7·11	7·12	7·12	6·72	6·04	6·38
Soluble mineral matter	1·40	1·34	1·36	1·20	1·19	1·19
Insoluble mineral matter	·76	·87	·82	·64	·57	·61
	100·00	100·00	100·00	100·00	100·00	100·00
Total nitrogen	·46	·50	·48	·43	·42	·42
Albuminoid nitrogen	·41	·38	·39	·35	·34	·34
Non-albuminoid nitrogen	·05	·12	·09	·08	·08	·08

CHEMICAL COMPOSITION of HAY.

	First Cut.	Second Cut.		Third Cut.	Average.
		First Analysis.	Second Analysis.		
Water	16·00	19·80	19·60	18·00	17·90
Soluble albuminoids	1·62	·85	·94	·54	1·02
Insoluble albuminoids	6·09	6·06	6·37	6·40	6·23
Digestible fibre	27·63	26·30	26·98	28·44	27·57
Woody fibre	23·30	21·64	22·68	22·40	22·62
Soluble carbohydrates, &c. ..	19·17	19·14	17·30	18·29	18·56
Soluble mineral matter	4·14	4·39	4·45	4·18	4·25
Insoluble mineral matter	2·05	1·82	1·68	1·75	1·85
	100·00	100·00	100·00	100·00	100·00
Total nitrogen	1·37	1·27	1·26	1·41	1·35
Albuminoid nitrogen	1·23	1·11	1·17	1·11	1·16
Non-albuminoid nitrogen ..	·14	·16	·09	·30	·19

Chemical Composition of the Silage removed from Silo.

	First Cut.		Second Cut.		Third Cut.		Fourth Cut.		Average.
	First Analysis.	Second Analysis.	First Analysis.	Second Analysis.	First Analysis.	Second Analysis.	First Analysis.	Second Analysis.	
Water	71·95	71·76	72·84	72·84	72·28	72·27	72·83	73·34	72·51
Volatile acids	·45	·44	·36	·36	·32	·33	·37	·26	·36
Non-volatile acids	·32	·33	·40	·41	·40	·37	·17	·36	·35
Soluble albuminoids	·53	·51	·86	·71	·45	·50	·78	·91	·65
Insoluble albuminoids	1·00	·81	·80	·83	·92	·98	·84	·50	·83
Digestible fibre	7·89	7·14	7·43	7·60	7·52	7·86	8·20	7·44	7·64
Woody fibre	8·02	7·82	8·02	7·69	7·73	8·08	7·33	8·70	7·93
Soluble carbohydrates, &c.	7·46	8·75	6·90	7·21	8·15	7·46	7·30	6·10	7·42
Soluble mineral matter	1·50	1·82	1·59	1·61	1·48	1·41	1·38	1·58	1·55
Insoluble mineral matter	·86	·62	·80	·74	·75	·74	·80	·81	·76
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
Total nitrogen	·52	·51	·56	·52	·48	·48	·52	·47	·51
Albuminoid nitrogen	·24	·21	·26	·24	·22	·23	·26	·23	·24
Non-albuminoid nitrogen	·28	·30	·30	·28	·26	·25	·26	·24	·27

QUANTITY and COMPOSITION of the GRASS put into SILO, and of the SILAGE PRODUCED; of the GRASS used for Hay, and of the HAY made.

	Total Weight.	Water.	Volatile Acids.	Non-Volatile Acids.	Soluble Albuminoids.	Insoluble Albuminoids.	Digestible Fibre.	Woody Fibre.	Soluble Carbohydrates, Chlorophyll, &c.	Soluble Mineral Matter.	Insoluble Mineral Matter.	Total Nitrogen.	Albuminoid Nitrogen.	Non-Albuminoid Nitrogen.
GRASS:—	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st day's filling, July 2, 1886	23,677	16,402	..	..	28	557	2488	2001	1685	322	194	113	92	21
2nd day's filling, July 3, 1886	9,103	6,706	..	..	19	176	790	669	580	108	55	38	31	7
Total	32,780	23,108	..	..	47	733	3278	2670	2265	430	249	151	123	28
Silage removed ..	30,389	22,035	109	106	197	252	2326	2409	2254	471	230	155	73	82
Loss	2,391	1,073	+109	+106	+150	481	952	261	11	+ 41	19	+ 4	50	+ 54
Loss per 100 lbs. of fresh grass ..	7·29	3·27	+·33	+·32	+·46	1·47	2·90	·79	·03	+·12	·06	+·01	·15	+·16
GRASS:—														
1st day's cutting, July 2, 1886	25,859	17,912	..	..	31	607	2720	2185	1841	351	212	124	101	23
2nd day's cutting, July 3, 1886	8,583	6,323	..	..	18	166	744	631	547	102	52	36	29	7
Total	34,442	24,235	..	..	49	773	3464	2816	2388	453	264	160	130	30
Hay	11,152	1,996	..	..	113	694	3079	2522	2069	473	206	150	129	21
Loss	23,290	22,239	..	..	+ 64	79	385	294	319	+ 20	58	10	1	9
Loss per 100 lbs. of fresh grass ..	67·62	64·57	..	..	+·18	·23	1·11	·85	·92	+·05	·17	·02	..	·02

To sum up, we have the following results :—

100 parts of grass produced :—		100 parts of grass produced :—	
Good silage	88·15	Good hay	29·77
Inferior and mouldy silage	4·56	Inferior hay and waste ..	2·61
Loss by fermentation, evaporation, &c.	7·29	Water and loss in making hay	67·62
	100·00		100·00

In stating the latter result, as regards the hay, it should be mentioned that the stack being quite a small one, the consequent loss at the sides, due to weathering, &c., was necessarily greater in proportion than would have been the case had a large stack been made.

We consider, in conclusion, the respective areas of land used for producing the hay and silage respectively. In all, $5\frac{1}{2}$ acres were cleared; this gives the yield of the field as 5 tons 9 cwt. 0 qr. 14 lbs. of grass per acre, or 1 ton 15 cwt. 1 qr. 9 lbs. of hay per acre. We found from the feeding experiment that, practically, an equal increase in live-weight was obtained from the silage used up to March 10, 1887, and from the whole of the hay, the rick having been finished on that date. Calculating the amount of grass represented by the quantities consumed up to March 10, we have the conclusion that

28,995 lbs. of grass, or the produce of $2\frac{2}{5}$ acres ..	converted into silage	produced equal feeding results.
34,442 lbs. of grass, or the produce of $2\frac{4}{5}$ acres ..	converted into hay	

In the above calculation, the acreages given have been reckoned as producing the whole of the silage and hay, whether good or bad, i.e., including all waste.

This experiment accordingly leaves the following point to be practically determined by the farmer in each individual case: Does it cost more to make $2\frac{2}{5}$ acres of grass into silage, or $2\frac{4}{5}$ acres into hay?

Additional Experiment conducted at Wilmington, Salop.

Towards the close of 1886, I had the pleasure of receiving from Mr. W. Ernest Evans, of School Gardens, Shrewsbury, a kind offer to conduct, free of cost to the Royal Agricultural Society, an experiment on ensilage at a farm at Wilmington, near Shrewsbury, which Sir Offley Wakeman, Bart., had in hand; the landlord being good enough to allow the stock and produce on the farm to be used for the experiment. This offer I gladly accepted, and with the co-operation of Mr. J. Bowen-Jones, of Ensdon House, Montford Bridge, Salop, who visited the farm

with me, it was arranged to conduct an experiment parallel to our own at Woburn, though with a different breed of bullocks, viz. Welsh bullocks. Ultimately eight beasts were selected and all necessary details arranged, Mr. Evans giving every facility and providing whatever was required. Fortunately also there was an intelligent bailiff at hand, and I am pleased to say that the experiment was carefully and very satisfactorily carried out, accounts of the feeding and other matters being forwarded to me weekly.

The bullocks chosen were eight Welsh bullocks about four years old, all being tied up in the same shed. Their weights on February 14, 1887, at the commencement of the experiment, were as follows:—

Weights of Bullocks at Commencement, Feb. 14, 1887.

Receiving Silage.				*Receiving Hay.*			
Bullock.	cwts.	qrs.	lbs.	Bullock.	cwts.	qrs.	lbs.
No. 1	10	0	18	No. 5	10	1	15
No. 2	10	1	2	No. 6	9	3	4
No. 3	9	2	15	No. 7	9	2	10
No. 4	9	2	18	No. 8	9	3	26
	39	2	25		39	2	27

The hay and silage were made from the grass of a field on the farm, but unfortunately no record had been made of the relative acreage used for the one or the other. The bullocks were allowed per head daily 3 lbs. of decorticated cotton-cake and 3 lbs. of maize-meal; water, silage, and hay being given *ad libitum*, but in all cases weighed.

The silage bullocks began by taking 57 lbs. of silage and 29 lbs. of water, and the hay bullocks about 20 lbs. of hay and 68 lbs. of water. The amount of silage consumed increased slightly to about 66 lbs. per head daily, and that of hay to 22 lbs. or 23 lbs. Some parts of the silage being drier than others, proportionately more water was at times taken. The average amounts consumed during the whole period by each bullock per day were:—

	By Bullocks receiving Silage.		By Bullocks receiving Hay.
Silage	67 lbs.	Hay	22 lbs.
Water	29 „	Water	72 „
	96 lbs.		94 lbs.

The experiment was continued until May 6, a period of eighty days, when Mr. J. Bowen-Jones again visited the farm with Mr. Evans and myself, and the bullocks were weighed in our presence:—

WEIGHT OF BULLOCKS ON MAY 6, 1887.

Receiving Silage.

Bullock.	cwts.	qrs.	lbs.
No. 1	11	2	0
No. 2	11	1	17
No. 3	10	2	9
No. 4	10	3	7
Total of 4 bullocks on May 6	44	1	5
Total on Feb. 14 ..	39	2	25
Gain during 80 days ..	4	2	8
Gain per head daily ..			1·6 lbs.

Receiving Hay.

Bullock.	cwts.	qrs.	lbs.
No. 5	11	2	0
No. 6	10	1	15
No. 7	10	1	27
No. 8	11	0	11
Total of 4 bullocks on May 6	43	1	25
Total on Feb. 14 ..	39	2	27
Gain during 80 days	3	2	26
Gain per head daily ..			1·3 lbs.

It will be seen that the bullocks on silage did rather better than those on hay, the respective daily gain per head being :—

With silage, 25·6 oz., or, roughly speaking, $1\frac{1}{2}$ lbs.
With hay, 21·0 oz., or, say $1\frac{1}{4}$ lbs.

Mr. Evans has also gone into some calculations of the cost of the increase, and in his conclusions, I may mention, he reckons that the cost of each pound of increase of dead-weight was for the whole period :—

In the case of silage, $7\frac{2}{3}$*d.*
" " hay, $9\frac{2}{5}$*d.*

As the bullocks were not slaughtered at the conclusion of the experiment, it will be of course understood that this can only be an approximation.

Appended I give analyses of the silage and the hay :—

	Silage.	Hay.
Moisture	75·31	13·33
Soluble albuminoids	·36	1·00
Insoluble albuminoids	1·32	6·31
Digestible fibre	7·22	30·17
Woody fibre	8·11	25·80
Volatile acids (reckoned as acetic acid)	·29	..
Fixed acids (reckoned as lactic acid) ..	·17	..
Soluble carbohydrates, chlorophyll, &c.	5·09	16·21
Soluble mineral matter	1·32	4·64
Insoluble " "	·81	2·54
	100·00	100·00
Total nitrogen	·40	1·35
Albuminoid nitrogen	·27	1·17
Non-albuminoid nitrogen	·13	·18

Comparing these analyses with those of the silage at Woburn already recorded in this paper, it will be noticed that although the silage was supposed to be "sweet" it really was not so, and there was nearly as much acid as in that used in the Woburn experiments. The fact is that some parts were "sweet" and some were "sour." When people make, as they think, "sweet" silage, there is generally great variation in different parts of the silo, some portions being sweet and others sour, some wetter and some drier.

Though, as it is almost needless for me to say, analyses do not in themselves accurately represent the differences between good and bad hay, nevertheless it will be readily noticed that the Wilmington hay contained a decidedly larger proportion of indigestible woody matter than the Woburn hay. As a matter of fact, while the Woburn hay was of very fair quality, that at Wilmington was very inferior indeed, the land off which it came being poor. The silage on the other hand was really well made; there was no great amount of loss by moulding; indeed, comparing the silage and the hay in this particular case, I should not hesitate to describe the grass as having produced better silage than hay. A reference to the analysis will also show that whilst in the Wilmington hay there was so much more woody fibre than in that used at Woburn, the silage on the other hand did not contain more. I must not place too much reliance on this, owing to the grass not having been sampled beforehand, but I mention it as perhaps in some way explanatory of the feeding result.

The amount of increase in the bullocks was small, and considerably below the Woburn average. At the conclusion the beasts were not nearly fat, and were very wild upon being turned out.

The experiment as a parallel one has been of considerable interest, and to Mr. Evans much credit is due for the care and attention which he gave throughout, and for an example set, which, if followed by others, would be of much aid in the cause of agricultural research.

XVIII.—*Sheep-Feeding Experiments conducted at Crawley Mill Farm, Woburn, in the Winter of* 1886–7. By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., Consulting Chemist to the Society.

DURING the winter of 1885–6, I carried out at Woburn some experiments on sheep-feeding, with the object of getting information upon the value of cereals, especially wheat, as com-

pared with cake, when used as additional food for feeding off turnips on the land by sheep.

The results which were then obtained * were, somewhat unexpectedly, about equally favourable to both linseed-cake and wheat. The experiment, conducted under very severe conditions of weather, it was considered desirable to repeat another year, and this was accordingly done. Briefly to summarise the former experiment, it may be mentioned that the sheep were a cross of the Hampshire and Oxfordshire Downs, about ten months old; forty sheep being divided into five pens of eight sheep each. Sliced Swedish turnips were supplied to them *ad libitum*, as also hay-chaff. The experiment lasted for 106 days, the amounts of additional foods given being ½ lb. per head daily for 33 days, and ¾ lb. per head daily for 73 days.

The relative costs per pound of increase in live weight were:—

Additional Food.	*d.*
Pen I.—Linseed-cake	1·39
Pen II.—Linseed-cake and undec. cotton-cake mixed	1·38
Pen III.—Wheat	1·00
Pen IV.—Oats and barley mixed	1·39
Pen V.—Oats and split beans mixed	1·66

Accordingly, if considered as food only, wheat gave the best monetary return, and then linseed-cake. When, however, the manurial values were taken into account also, the final result was to place wheat and linseed-cake on about an equality, and decidedly in advance of the mixed foods. The winter was one of a very trying nature, and unfortunately five sheep died during the experiment. There was, however, no clear evidence that the wheat had been (as it was supposed it would prove) injurious *per se*. On repeating the experiment last winter, a few alterations in the plan were made. Thus, while linseed-cake and wheat were retained, decorticated cotton-cake was introduced, and both it and linseed-cake were tried alone, and also in combination with barley. The following was the plan adopted as regards additional foods:—

Pen I. received Linseed-cake.
Pen II. „ Wheat.
Pen III. „ Decorticated cotton-cake.
Pen IV. „ Linseed-cake and barley, in equal proportions.
Pen V. „ Decorticated cotton-cake and barley, in equal proportions.

The cakes were given broken up into small pieces, especial care being taken with the decorticated cotton-cake. The wheat was given whole, this form having been found in the previous

* 'Journal,' vol. xxii. 2nd Series, p. 514.

ear to have answered best. The barley was not ground into ieal, but was given roughly crushed, or "grittled" as it is ·rmed. The foods were analysed from time to time: their verage compositions are given in the following table:—

	Linseed-Cake.	Decorticated Cotton-Cake.	Wheat.	Barley.
Moisture	13·55	9·84	17·22	17·51
)il	11·83	10·70	1·48	2·22
Albuminous compounds	25·56	44·44	8·76	8·53
Starch, mucilage, digestible fibre, &c...	32·09	22·47	69·72	65·17
Woody fibre	9·70	4·83	1·13	4·12
Mineral matter	7·27	7·72	1·69	2·45
	100·00	100·00	100·00	100·00
* Containing nitrogen ..	4·09	7·11	1·40	1·36

	Hay-Chaff.	Swedes.
Water	15·92	89·25
*Albuminous compounds	9·14	·97
Sugar, digestible fibre, &c. ..	46·69	8·11
Woody fibre	21·55	·97
Mineral matter	6·70	·70
	100·00	100·00
* Containing nitrogen ..	1·47	·15

The prices of the different foods as used for the experiment vere:—

	s.	*d.*		£	*s.*	*d.*	
Linseed-cake (including cost delivered 8*l.* 10*s.* per ton, cartage 1*s.* 6*d.* per ton, and cost of breaking 3*s.* 4*d.* per ton) .. .. per 112 lbs.	8	9	or	8	14	10	per ton.
Decorticated Cotton-cake (including cost 6*l.* 10*s.* per ton, carriage 7*s.* 6*d.*, cartage 1*s.* 6*d.*, cost of breaking 5*s.* per ton) .. .. .. per 112 lbs.	7	2½	or	7	4	0	per ton.
Wheat, white (home grown, chaff blown out but no offal removed—1 quarter = 504 lbs.) per 112 lbs.	6	8	or	1	10	0	per quarter.
Barley (home grown—no offal removed—cost of grittling, including cartage to and fro, 2*s.* per quarter—1 quarter = 448 lbs.) .. .. per 112 lbs.	5	6	r	1	2	0	per quarter.

In order to make the comparison a fair one, the prices of the different foods have been stated as above, including all charges to the time of their being given to the sheep.

The sheep were the same kind of cross-bred sheep as used before and of similar age, but were decidedly stronger animals. They were 40 in number, divided into five pens of eight sheep each; and before the experiment began they were put on roots for a short time, to accustom them to the diet. The weights at commencement were as follows:—

WEIGHTS of SHEEP put under EXPERIMENT on DECEMBER 23, 1886.

	Pen I.			Pen II.			Pen III.			Pen IV.			Pen V.		
	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
	1	1	7	1	1	16	1	0	14	1	1	12	1	2	15
	1	1	10	1	1	22	1	1	0	1	2	2	1	1	12
	1	1	7	1	1	13	1	1	5	1	0	17	1	0	14
	1	1	6	1	1	8	1	1	2	1	1	18	1	1	16
	1	1	26	1	0	26	1	1	21	1	2	7	1	1	14
	1	1	5	1	1	4	1	1	10	1	1	21	1	1	10
	1	2	10	1	2	8	1	3	0	1	1	9	1	1	15
	1	2	2	1	2	3	1	2	19	1	1	14	1	2	5
Total of 8 sheep	11	0	17	11	0	16	11	0	15	11	0	16	11	0	17

All the sheep at once took well to their foods; the swedes were sliced and given *ad libitum*, a quantity, beginning with about 23 lbs. each sheep daily, being weighed out to them from time to time as required: hay-chaff was also given *ad libitum*. At first the sheep ate 4 oz. of hay-chaff per head daily, after two days they would eat 6 oz., and by January 1, 1887, 8 oz. per head daily. The additional food given to each pen was at first ½ lb., but was increased on January 14 to ¾ lb. per head daily. After a time it was noticed that the sheep in Pens 1, 2, and 3 would eat per pen about 20 lbs. of roots daily more than those in the other pens; the quantity of roots consumed in Pens 1, 2, 3 rose gradually from 23 lbs. to 30 lbs. per head daily, while in Pens 4 and 5 it did not go above 27 lbs.

The winter, though cold and prolonged, was dry, and not nearly such a trying one for the sheep as the preceding one had been; fortunately too, for the value of the experiment as confirmatory of the previous one, no sheep died. Several, however, were at different times ill, viz., No. 1 (linseed-cake pen), No. 32 (linseed-cake and barley pen), Nos. 28 and 37 (decorticated cotton-cake and barley pen). No. 1 suffered from a breaking out on the jaw; No. 32 had a swollen face; and the other two seem to have been unwell throughout the greater part of the time.

These elements of uncertainty form, of course, one of the troublesome points in all experiments of this kind; and it is only by taking a sufficient number of animals, and by repeating experiments, that such circumstances can be prevented from vitiating the results. In the present instance, whilst it will be noticed that the sheep named lost in weight, in some cases more and in others less, it would be hardly fair to leave them out of account altogether, inasmuch as it is probable that the other sheep in the pens profited at the same time by having more than their ordinary share.

As the spring advanced, the sheep fed on linseed-cake were found to be decidedly the most healthy-looking of all, and their wool was brighter and more compact in character than that of the sheep of other pens; the wool of those in Pens 2, 4, and 5 appearing to be especially loose. After continuing the experiment for 95 days the swedes were consumed, and the sheep were weighed on March 28, the weights then being as follows:—

WEIGHTS of the FIVE PENS of SHEEP at the end of 95 DAYS, DECEMBER 23, 1886, to MARCH 28, 1887.

	Pen I. Linseed-Cake.	Pen II. Wheat.	Pen III. Decorticated Cotton-Cake.	Pen IV. Linseed-Cake and grittled Barley.	Pen V. Decorticated Cotton-Cake and grittled Barley.
	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.	cwt. qrs. lbs.
Weights of Sheep ..	1 0 1	1 2 23	1 3 0	1 2 10	1 3 11
	1 3 21	1 3 17	1 2 12	1 1 26	1 3 15
	1 2 24	1 3 4	1 2 8	1 1 2	1 1 21
	1 3 4	1 2 8	1 2 16	1 2 4	1 1 5
	1 3 14	1 1 22	1 3 13	1 3 20	1 0 20
	1 2 10	1 2 15	1 2 18	1 3 12	1 2 18
	1 3 2	1 2 19	1 3 27	1 2 9	1 2 10
	1 3 11	1 2 16	1 2 27	1 2 24	1 2 13
Total weight of sheep on March 28, 1887	13 2 3	13 1 12	13 3 9	12 3 23	12 2 1
Total weight on Dec. 23, 1886 ..	11 0 17	11 0 16	11 0 15	11 0 16	11 0 17
Total increase in weight of sheep during 95 days ..	2 1 14	2 0 24	2 2 22	1 3 7	1 1 12
Equivalent in lbs. ..	266 lbs.	248 lbs.	302 lbs.	203 lbs.	152 lbs.
Increase per head during the whole period	33 lb. 4 oz.	31 lb. 0 oz.	37 lb. 12 oz.	25 lb. 6 oz.	19 lb. 0 oz.
Daily increase per head	5·6 oz.	5·2 oz.	6·4 oz.	4·3 oz.	3·2 oz.

It will be noticed that in Pen 1 there was a loss of weight in the case of one sheep only (though a rather serious one), viz., the sheep No. 1, mentioned before as having been ill. In Pens 2 and 3 there was no case of loss whatever; in Pen 4, one loss of a few pounds (No. 32); and in Pen 5, two heavier losses (Nos. 28 and 37). All these occurred with sheep which had been observed throughout the experiment not to be doing well.

It was thought that it might be of interest to see what difference there was in the weights of wool, and the sheep were accordingly weighed both before and after washing and shearing. The weights of the fleeces from the respective pens were as follows:—

	Weight of Fleeces. qrs.	lbs.
Pen I. (8 sheep)	3	8
Pen II. "	3	3
Pen III. "	3	$8\frac{3}{4}$
Pen IV. (7 sheep, one having died in the interval) ..	3	$1\frac{1}{2}$
Pen V. (8 sheep)	3	4

It will be seen that the differences of weight in the wool were but trifling, though it was observed that the quality of the wool of the cake-fed sheep was decidedly better than that of the wheat-fed ones.

The average quantities of roots consumed by the sheep per head daily during the whole period were:—Pen I., 28·8 lbs.; Pen II., 27·8 lbs.; Pen III., 28 lbs.; Pen IV., 26·5 lbs.; Pen V., 26·4 lbs.

The Table of increase of weights at the close of the experiment shows the greatest increase to have been due to Decorticated Cotton-cake; the next best, to Linseed-cake; and then came Wheat, the mixed foods not having given nearly so good results. Speaking generally, therefore, the combination of starchy foods with the more nitrogenous ones did not prove so successful. Taking the entire diets given in the case of the three best pens, we have the following as the daily allowance for each sheep:—

Pen I.	Pen II.	Pen III.
29 lbs. Swedes.	28 lbs. Swedes.	28 lbs. Swedes.
$\frac{1}{2}$ lb. Hay-chaff.	$\frac{1}{2}$ lb. Hay-chaff.	$\frac{1}{2}$ lb. Hay-chaff.
$\frac{3}{4}$ lb. Linseed-cake.	$\frac{3}{4}$ lb. Wheat.	lb. Decorticated Cotton-cake.

The composition of these diets is given on the opposite page.

It may be noted that the albuminoid ratio 1 : 5 was that which had in last year's experiments also given the best feeding result.

	Pen I.		Pen II.		Pen III.	
	Daily Amount in lbs.	Percentage Composition of Mixed Food.	Daily Amount in lbs.	Percentage Composition of Mixed Food.	Daily Amount in lbs.	Percentage Composition of Mixed Food.
Moisture	26·06	85·92	25·20	86·15	25·15	85·96
Oil	·09	·29	·01	·04	·08	·28
*Albuminous compounds	·52	1·71	·38	1·31	·65	2·22
Sugar, mucilage, digestible fibre, &c.	2·91	9·61	3·02	10·34	2·67	9·13
Woody fibre	·46	1·52	·39	1·32	·41	1·42
Mineral matter	·29	·95	·25	·84	·29	·99
	30·33	100·00	29·25	100·00	29·25	100·00
* Containing nitrogen	·48	1·57	·44	1·49	·48	1·64
Albuminoid ratios	1 : 7		1 : 9		1 : 5	

Next should be taken into account the expense of the additional foods, and their relative cost in producing an increase in live-weight.

PEN I.

		£	s.	d.
522 lbs. Linseed-cake	cost	2	0	9½

PEN II.

522 lbs. Wheat	cost	1	11	1

PEN III.

522 lbs. Decorticated Cotton-cake	cost	1	13	7

PEN IV.

261 lbs. Linseed-cake	cost	1	0	5
261 lbs. Grittled Barley	„	0	12	10
		£1	13	3

PEN V.

261 lbs. Decorticated Cotton-cake	cost	0	16	9½
261 lbs. Grittled Barley	„	0	12	10
		£1	9	7½

Hence the relative cost per lb. of increase in live weight was:—

	d.
Pen I.—Linseed-cake	1·84
Pen II.—Wheat	1·50
Pen III.—Decorticated Cotton-cake	1·33
Pen IV.—Linseed-cake and Barley	1·96
Pen V.—Decorticated Cotton-cake and Barley	2·34

From these figures it will appear that the decorticated cotton-cake produced not only the largest increase, but also this at the lowest cost. The wheat as a feeding material stood next in point of cheapness, and then linseed-cake, the difference between them being very much the same as noted last year, the advantage lying rather more in favour of linseed-cake.

Taking next the assumed manure-values according to Lawes and Gilbert's tables, we have the following:—

	Manure Value. Per Ton.				Per 522 lbs. consumed.		
	£	s.	d.		£	s.	d.
Linseed-cake	3	18	6	..	0	18	3½
Wheat	1	8	7	..	0	6	8
Decorticated Cotton-cake	5	13	0	..	1	6	4

As the result of considering the foods in regard to their value, both for feeding and manurial purposes, we have the following:—

	Linseed. d.		Wheat. d.		Decorticated Cotton-cake. d.
Cost of additional food for each lb. of live weight	1·84	..	1·50	..	1·33
Less, manurial value	·82	..	·32	..	1·04
Nett cost of additional food for each lb. of live weight ..	1·02	..	1·18	..	·29

The value of the feeding result as regards the use of decorticated cotton-cake is further enhanced largely by its high manurial properties; and it stands out in this respect as decidedly the best food. Between the linseed and the wheat there is a difference in favour of linseed-cake, though not a large one, and the former experiment is in great measure confirmed as to the possible profitable use of wheat for feeding purposes. The fact that all the sheep fed on wheat went through the experiment without any illness whatever, confirms the observation before made that it can be quite safely used for

sheep. The linseed-cake might possibly have given a higher result but for the loss of weight in the case of one sheep.

I would, in conclusion, repeat the caution given last year, that, in endeavouring to give an idea of the relative values of the foods, both as feeding and manurial materials, there are a number of causes which will in individual cases render alterations necessary. It will be evident too that, owing to fall of prices since the experiment began, the manurial values given appear somewhat too high at the present time. I have therefore stated the circumstances exactly as they existed at the time on the farm at which the particular experiment was made. Still, although local considerations and fall of prices may modify the conclusions, the value of decorticated cotton-cake must remain indubitable.

XIX.—*Field Experiments on Cabbages at Rusper, Horsham.* By BERNARD DYER, B. Sc. (Lond.), F.C.S., F.L.S.

BEING desirous of carrying out, during the season of 1886, some field experiments on cabbages, I was fortunate in obtaining the willing co-operation of Mr. A. F. Parbury, of Rusper, Horsham, Sussex, who has on previous occasions been good enough to place his farm resources at my disposal for experiments, some of which have been already described in this Journal. The cabbage-crop is one the value of which is too apt to be underrated, and it has so far received very little experimental attention.

The field selected for the purpose was fairly typical of the land of the neighbourhood, being a light-coloured adhesive clay. Three acres were chosen, which had in 1882–3 borne trifolium, manured with 12 loads of dung per acre, and with liquid manure. The crop was a good one, and yielded two months' good cutting. In 1883–4 wheat was grown without manure. In November 1884, about 35 tons of pond refuse, mixed with 5 tons of lime, were spread on the field, spring oats being sown in 1885, and top-dressed with 1 cwt. of nitrate of soda per acre. The field was ploughed in the autumn of 1885, and about 11 tons of dung per acre were spread during the winter. After lying for some weeks frost-bound, the dung was finally ploughed in during March 1886. The land was cross-ploughed, and repeatedly harrowed and rolled, in order to get as good a seed-bed as possible—always a tedious and somewhat unsatisfactory operation on such land as this.

An analysis of the soil yielded the following results:—

	Soil dried at 212° F.
Silicious matter insoluble in hydrochloric acid ..	79·366
Oxide of iron	5·993
Alumina	5·883
Lime	·767
Magnesia	·233
Potash	·379
Soda	·127
Phosphoric acid	·140
Nitric acid	·001
Sulphuric acid	·054
Chlorine	·005
* Organic matter, combined water, &c.	7·052
	100·000
* Containing nitrogen	·195

The seed (Carter's Drumhead Cabbage) was drilled at the rate of $3\frac{1}{2}$ lbs. per acre, on May 5th and 6th.

The artificial manures were sown broadcast immediately

PLOTS $\frac{1}{4}$ ACRE each. MANURES stated in QUANTITIES PER ACRE.

A.	B.	C.	D.	E.	F.
"Equalised" Peruvian Guano $2\frac{1}{2}$ cwt.	Fish Guano 3 cwt.	Superphosphate 3 cwt., Belgian Phosphate 1 cwt. Top-dressed with Nitrate of Soda 2 cwt.	No Artificial Manure.	Superphosphate 3 cwt., Belgian Phosphate 1 cwt. Top-dressed with Nitrate of Soda 2 cwt., Salt 3 cwt.	Top-dresse[d] with Nitra[te] of Soda 2 c[wt.], Salt 3 cw[t.]
G.	**H.**	**I.**	**J.**	**K.**	**L.**
Superphosphate 3 cwt., Belgian Phosphate 1 cwt., Kainit 6 cwt. Top-dressed with Nitrate of Soda 2 cwt.	Kainit 6 cwt. Top-dressed with Nitrate of Soda 2 cwt.	Superphosphate 3 cwt., Belgian Phosphate 1 cwt., Sulphate of Ammonia $1\frac{1}{2}$ cwt.	Superphosphate 3 cwt., Belgian Phosphate 1 cwt.	Superphosphate 3 cwt., Belgian Phosphate 1 cwt., Sulphate of Ammonia $1\frac{1}{2}$ cwt., Salt 3 cwt.	Sulphate [of] Ammoni[a] $1\frac{1}{2}$ cwt., Salt 3 cw[t.]

Note.—All the plots were manured as well with farmyard-manure, at the rate of about 11 tons per acre.

before drilling the seed, except in the case of nitrate of soda, which (together with salt when used) was top-dressed in July, after the plants were singled out.

Opposite is given a plan of the experimental plots, each of which was a quarter of an acre in extent. On each plot is shown the nature and quantity of manure applied.

The superphosphate was mixed with one-third of its weight of fine Belgian phosphate before sowing, which was advantageous, partly to make it sow more readily (it being rather damp), and partly for the purpose of neutralising the acidity of the superphosphate, some previous experiments on this particular land having pointed to the advantage of using on it phosphates in a finely divided rather than in a readily soluble acid form.

Analyses were made of all the artificial manures. The "Equalised" Peruvian guano contained 15·14 per cent. of phosphoric acid, equal to 33·05 per cent. of phosphate of lime; and 7·17 per cent. of nitrogen, equal to 8·70 per cent. of ammonia. The fish guano contained 17·75 per cent. of phosphate of lime, and nitrogen equal to 9·81 per cent. of ammonia. It contained 5·37 per cent. of oil. The superphosphate contained 24·60 per cent. of soluble phosphate, and the Belgian phosphate 44·07 per cent. of phosphate of lime. The nitrate of soda was of 96 per cent. purity, and the sulphate of ammonia contained 24·99 per cent. of ammonia. The kainit contained 23·49 per cent. of sulphate of potash.

The young plant suffered in its early stages from a long and severe drought, the effect of which was to kill off part of it on some of the plots. Where practicable, the gaps were filled up at singling time, but some of the transplanted plants failed to do well, and in consequence certain of the plots remained irregular or patchy to the end. These plots are specified on p. 428, and as their condition was duly noted, they have not been allowed to vitiate the conclusions from the experiments, as would have been the case if their actual yield had been recorded without comment on their irregularity. The singling out was done in July, and the appearances of the various plots were noted from time to time.

The cabbages were pulled during November and December, some, owing to the frost, remaining out until January; but as all had practically ceased growing before any were pulled, little, if any, discrepancy would be introduced by the fact of all not being pulled at the same time. The whole produce of each plot was weighed.

The following are the yields calculated per acre. It is to be remembered that dung (about 11 tons per acre) was used in all

cases, so that the details of manuring given below refer only to the artificials used :—

Plot.	Manure per Acre.	Yield per Acre.			
		Tons	cwt.	qrs.	lbs.
A	$2\frac{1}{2}$ cwt. "Equalized" Peruvian guano	9	0	2	8
B	3 cwt. fish guano	5	11	2	8
C	3 cwt. superphosphate, 1 cwt. Belgian phosphate, 2 cwt. nitrate of soda	6	1	0	21
D	No artificials	3	9	0	0
E	3 cwt. superphosphate, 1 cwt. Belgian phosphate, 2 cwt. nitrate, and 3 cwt. salt	11	16	1	20
F	*2 cwt. nitrate and 3 cwt. salt*	*8*	*8*	*1*	*4*
G	3 cwt. superphosphate, 1 cwt. Belgian phosphate, 2 cwt. nitrate, and 6 cwt. kainit	10	1	2	24
H	*2 cwt. nitrate and 6 cwt. kainit*	*6*	*7*	*0*	*24*
I	3 cwt. superphosphate, 1 cwt. Belgian phosphate $1\frac{1}{2}$ cwt. sulphate of ammonia	5	13	0	0
J	3 cwt. superphosphate and 1 cwt. Belgian phosphate	4	9	1	12
K	*3 cwt. superphosphate, 1 cwt. Belgian phosphate, $1\frac{1}{2}$ cwt. sulphate of ammonia, and 3 cwt. salt* ..	*6*	*0*	*0*	*16*
L	$1\frac{1}{2}$ cwt. sulphate of ammonia and 3 cwt. salt	7	4	0	8

Of the three plots printed in italics, F was patchy, owing to its having suffered in the drought; K was defective, owing to partial failure of the plot at one end ; while H was quite spoilt by its irregularity.

The table on page 429, obtained by deducting from the acreage yield of each plot the yield of the land which received no artificials, gives the increase obtained in each case by the use of the artificials. The cost of each dressing, at the retail prices current at the time, inclusive of carriage, is also given, viz., superphosphate 3*l.* 10*s.* per ton, Belgian phosphate 3*l.* 10*s.*, Peruvian guano 10*l.* 10*s.*, fish guano 7*l.*, sulphate of ammonia 13*l.* 5*s.*, nitrate of soda 12*l.*, kainit 3*l.* 5*s.*, and salt 2*l.* per ton.

It is again to be noticed that the lines printed in italics, viz., K, H, F, refer to plots the actual yield of which is not to be accepted as truly representative of the results due to the manure used, owing to the plant having been defective, as previously noted.

It will be seen that the crop produced by dung alone was less than $3\frac{1}{2}$ tons per acre. Although about eleven tons of dung per acre had been used, it was not dung of by any means high quality, and was made chiefly by dairy cows and not kept under cover. The following table, showing the yield per acre after deducting for the dung which was used throughout, shows that artificials gave an increase per acre varying from 1 ton to nearly $8\frac{1}{2}$ tons of cabbages.

These experiments, made under the conditions obtaining, viz.,

Plot.	Artificial Manure.	Cost of Artificial Manure per Acre.			Gain in Crop due to Artificials.			
		£	s.	d.	Tons	cwt.	qrs.	lbs.
J	Phosphates only	0	14	0	1	0	1	12
B	Fish guano	1	1	0	2	2	2	8
I	Phosphates, with sulphate of ammonia	1	14	0	2	4	0	0
K	*Phosphates, sulphate of ammonia, and salt*	*2*	*0*	*0*	*2*	*11*	*0*	*16*
C	Phosphates and nitrate of soda ..	1	18	0	2	12	0	24
H	*Nitrate of soda and kainit*	*2*	*5*	*0*	*2*	*18*	*0*	*24*
L	Sulphate of ammonia and salt ..	1	6	0	3	15	0	8
F	*Nitrate of soda and salt*	*1*	*10*	*0*	*4*	*19*	*1*	*4*
A	"Equalised" Peruvian guano ..	1	6	3	5	11	2	8
G	Phosphates, nitrate of soda, and kainit	3	0	0	6	11	2	24
E	Phosphates, nitrate of soda, and salt	2	4	0	8	7	1	20

a poor clay soil and dry weather during the most critical time of growth, show:

1. That the most efficient dressing was one of phosphates with 2 cwt. of nitrate of soda and 3 cwt. of salt per acre, which produced 8 tons 7 cwt. extra cabbages at a cost of 2*l.* 4*s.*, or about 5*s.* per ton of additional cabbages.

2. That the next largest additional yield, viz., 6 tons 11 cwt. per acre, was produced by a similar mixture, 6 cwt. kainit per acre being substituted for salt, but at a cost of about 9*s.* per ton of extra crop. It is here to be noted that the effect of the kainit is evidently due not to the potash, but to the salt it contains. The 6 cwt. of kainit contained about 2 cwt. of chloride of sodium or salt, and it failed, notwithstanding the potash in it, to do as much good as 3 cwt. of salt.

3. That the next best gain in crop was one of 5 tons 11 cwt. by the use of 2½ cwt. per acre of "Equalised" Peruvian guano, which cost 1*l.* 6*s.* 3*d.* per acre, making the cost of the additional cabbages about 5*s.* per ton.

4. That phosphates alone produced only 1 ton of cabbages per acre, and that nitrate and salt without phosphates, although they produced a very good increase, did not do nearly so well as when phosphates were used in conjunction with them. The plot on which nitrate and salt were used without phosphates (plot F) was too patchy to allow the 5 tons or so of extra cabbages grown on it to be taken as a fair yield, but the quality of the plants was good, and I am unable to say what the yield would have been but for the bare patches. Still, it would certainly have fallen very considerably below that of the best plot (E).

5. That phosphates and nitrate of soda without salt gave only about 2½ tons increase.

6. That sulphate of ammonia gave but poor results as compared with equivalent dressings of nitrate of soda, a fact probably in some degree due to continued dry weather. The superiority of the nitrate of soda plots was seen throughout the season in the luxuriance, dark colour, and generally vigorous appearance of the cabbages.

7. That fish guano only succeeded in producing about two tons of increase per acre. This seems to show that fish manure is not well adapted for such a close heavy clay soil; the fish, I should say, having scarcely become decomposed in time to benefit the plants, the oil in it further tending to retard the decomposition. Probably on a more open soil, where it would more readily become intimately mixed with the earth, or in a wetter season, the results might have been better.

It is noteworthy that while salt was clearly necessary to bring out the full action of phosphates and nitrates, yet Peruvian guano, without salt, produced excellent results. It is highly probable, however, that the addition of 2 to 3 cwt. of salt per acre to the guano would still further have increased the yield. The chief lesson to be learnt from these experiments is the high value of salt as a dressing for cabbages when a sufficiency of other suitable manurial ingredients is present.

From the results obtained, growers of cabbages might be recommended to use as an artificial dressing at seed time 4 cwt. of superphosphate per acre, if the soil is fairly calcareous, or, if not, to use 3 cwt. of superphosphate mixed with 1 cwt. of bone-meal, ground coprolite, or other finely-ground phosphate; top-dressing, after singling out, with 2 cwt. nitrate of soda per acre, mixed with 3 cwt. of salt.

As an alternative I would suggest a dressing of $2\frac{1}{2}$ cwt. per acre of Peruvian guano (8 to 9 per cent. of ammonia at seed time) mixed with 2 cwt. of salt, or the use of a like quantity of "low-ammoniacal" Peruvian guano, afterwards top-dressing with 1 cwt. nitrate of soda and 3 cwt. of salt.

The rainfall for the year, as registered by Mr. Parbury's rain-gauge on the farm, was as follows:—

1886.	Inches.	1886.	Inches.
January	3·53	July	2·98
February	0·80	August	1·87
March	2·01	September	2·35
April	1·76	October	3·12
May	4·00	November	3·65
June	·93	December	5·78

Total for the year, 32·78 inches.

XX.—*The Progress of the Hessian Fly.* By Charles Whitehead, F.L.S., F.G.S., of Barming House, Maidstone.

The appearance and progress of the Hessian Fly in Great Britain in 1886 have been recorded in the report of Miss Ormerod, the Consulting Entomologist of the Society, and in the official report written by Mr. C. Whitehead, the Agricultural Adviser of the Privy Council, and reproduced in the last volume of the Journal. It may be instructive and interesting now to give an account of the spread of this insect during the present year, with some details of the injuries occasioned to corn crops by its action.

In 1886 the attack of the Hessian Fly was first noticed at Revell's Hall, Hertford. It was confined to this farm and three farms near Ware in Hertfordshire, two farms close to Hitchin in Hertfordshire, one at Luton in Bedfordshire, and one near Romford in Essex. In Scotland the pupa-cases were only found near Inverness, and near Crieff in Perthshire. In 1887 the insect was found in no less than twenty counties in England, and ten in Scotland, causing in some instances considerable injuries, as will be shown further on.

During the last winter the pupa-cases were found in quantities by Mr. Palmer, of Revell's Hall, Hertford, among the cleanings or siftings, after threshing wheat grown in infested fields. From these, kept in breeding cages, specimens of the fly were bred in the late autumn, though no larvæ were found upon growing wheat-plants in the autumn season. Nor were any larvæ discovered upon growing wheat-plants and barley-plants during the spring of 1887. Directly the wheat-plants and barley-plants began to ripen, the pupa-cases were seen in exactly the same circumstances as in the previous year, imbedded close to the second joint of the stem and covered by the sheathing leaves. As a rule there were two or three round a joint. In some cases four or five were present, and in a few instances even six or seven were seen near one joint.

The injury caused to wheat-plants and barley-plants this year was exactly similar in its nature to that of last year; in fact it was characteristic of the attack of this insect. It was very much more widespread, though perhaps not much more serious in its effects than at Revell's Hall in 1886, except in one or two places in Scotland. The stems of the plants both of wheat and barley were bent down at the second joints from the exhaustion of the sap of the plants by the larvæ, as well as by their irritating action. The growth of the plants was checked, and either the formation of grains was altogether prevented, or they were rendered imperfect and small, and injured by the ears

falling on the ground. Infested fields of wheat and barley appeared to the casual observer as if cattle or sheep had been through them. Barley suffered more, perhaps, than wheat on the whole, and the attack was generally more severe on badly farmed land and upon poor, stony, or badly drained spots, and banks: or rather, the plants being weak were not able to bear up against the sap-draining effects of the larvæ upon them.

Wheat-plants of a stiff-strawed nature certainly showed the action of the insect upon them less than those of a less stout habit of growth. It follows, therefore, that upon well-farmed land with a strong, regular plant, the results would not be so serious as in the case of poor and indifferently cultivated soils. The drought also in these conditions tended to make the plants stunted, and more liable to receive injuries from insects. No special sorts of wheat were particularised as resisting the attack, but generally those of strong growth were noticed to have sustained the least damage. In experiments made in California it was proved that certain varieties of wheat were not affected by the Hessian Fly, while others growing in adjoining plots were extensively infested. A barley grower in Suffolk is of opinion that the finer sorts of barley, such as the Golden Melon and Peerless White, were more infested this season than more common kinds. But the question of the liability of certain sorts to the attack of the insect, and the comparative immunity of others, requires careful examination, and observations will be made in future seasons in order to determine this if possible, and to discover "fly-proof" varieties, as the Americans profess to have achieved. Packard says: "Of the different varieties of 'fly-proof' wheat, the Underhill variety has for a century been highly recommended. As Fitch remarks, its fly-proof qualities were supposed by many to be due to the hardness or solidity of its straw. The fly laid its eggs freely upon the leaves, but it was seldom if ever materially injured by it." * Further, Packard states that in Michigan the "Clawson" is apparently the favourite wheat on account of its fly-proof qualities.

The actual amount of loss sustained by this attack has varied much. In some cases not more than one stem in a square rood of ground could be found infested with pupa-cases. In others there were three or four per cent. of the stems having pupa-cases upon them. Upon a farm in Cambridgeshire it appeared as if there were at least ten per cent. of the stems attacked in certain fields; while in other fields adjoining no traces of the insect could be found. There had been no difference in the methods

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* 'The Hessian Fly.' By A. S. Packard, M.D. Department of the Interior, United States Entomological Commission, Bulletin No. 4.

of cultivation to account for the affection of some fields and the immunity of others; nor was there any appreciable distinction in this case between the attacked and the uninfested crops in respect of the vigour of the plants. In another part of Cambridgeshire the loss occasioned was estimated at four bushels per acre; in this instance the wheat-plants were observed to lose plant at the end of November, and to look weak in the early spring. It was thought that wireworms were the cause, and the land was dressed with $1\frac{1}{2}$ cwt. of nitrate of soda per acre and well rolled, without much beneficial result. The mischief was without doubt continuous throughout the early summer, as the straw was much scrawled and the ears on many of the infested stems merely contained "tail" corn. In the barley-field adjacent to these wheat-fields there was also considerable harm done to the plants. Evidently the flies of the spring generation hatched on the wheat-plants had flown to fresh fields and pastures new, and laid their eggs upon the barley-plants.

As a rule, it was found this season that barley-plants were more injured than wheat-plants. The reason of this is that the barley-plants, particularly those sown late, were prevented by the drought from growing away from the attacks of the larvæ; the wheat-plants, on the other hand, were well established before the drought set in, and, as is well known, these plants are able to resist drought in ordinary conditions. The loss in the wheat crop on some wheat land in Bedfordshire was held to be equal to two bushels per acre. No failure of plant was noticed in the autumn. The seed was put in during the first week in November, so that it may be assumed that the attack was not commenced until the spring, and that the flies which placed eggs upon the plants were those of the second generation, and came either from self-sown corn-plants in "seeds," or on the outsides of fields or from neighbouring wheat-fields. One or two wheat-fields in the vicinity were very slightly infested, appearing to have been attacked also in the spring. There were no other infested fields that could be discovered within some miles. It is, of course, possible that flies might have been borne by the wind from a long distance, as they carry a large amount of sail in the shape of wings, and would be wafted far and rapidly.

A wheat-field near Rochester, in Kent, was found to be very slightly infested, having only one stem in many hundreds with pupa-cases upon it, so that it may be said that the actual damage was next to nothing. Also at Halstead, in Kent, 25 miles distant from Rochester, the same degree of infestation was discovered upon wheat-plants, with no distinct damage. In several other parts of England and Scotland similar slight

traces of the insect were noticed. Unless steps are taken to destroy it, it is expected that there will be a more widespread attack next year in these localities. In some parts of Scotland the effect of the Hessian Fly was greater than in England. A farmer in Forfarshire reported that his loss was twelve bushels per acre, with a corresponding decrease in the quantity and value of the straw. Another Scotch farmer estimated that his crop had been lessened at least eight bushels per acre by the insect. A calculation was made by a practical man in Forfarshire that over a large district five per cent. of the crops of wheat and barley had been destroyed, both in respect of corn and straw.

At the same time, very exaggerated statements of loss were made. Reports that appeared in several newspapers of extensive injuries and of general attack were proved to be without foundation. It was declared that the pupa-cases might be found almost everywhere in England and Scotland, although there is no ground whatever for such an assertion. There is good reason to believe that owing to the diffusion of information upon the subject by the Agricultural Department of the Privy Council, and the enquiry of the Commissioners appointed by the Government, as well as to the action of Miss Ormerod, the Consulting Entomologist of the Society, and other workers, farmers were well posted up as to the Hessian Fly, and kept a good look out for it, so that the presence of the insect was detected and reported.

Doubts have been suggested as to whether the Hessian Fly has not been in this country for a long while. It is urged by some that it has been here for some years, but was not noticed until 1886. If this be the case, the attack of the insect and the consequences of its attack must have been inappreciable, or they would have been noticed before. Now, according to the habits and history of the Hessian Fly in other countries, its increase and injuries have advanced very rapidly. For example, in America, where it first appeared in 1779, "each succeeding generation regularly enlarged the sphere of its devastations in every direction." * Again, in Russia no traces of the fly were proved to have been seen until 1879, and since then it has, according to Dr. Lindeman, spread over nearly three parts of the corn-growing districts of that country.†

Curtis, the careful economic entomologist, would have found the Hessian Fly if it had been in England during the period of his researches. He alludes to this insect in his admirable

* *Op. cit.*
† 'Die Hessen Fliege in Russland.' Von Dr. K. Lindeman.

'Farm Insects,'* and gives a short description of it showing that he was perfectly acquainted with its form and its methods of destruction. Before Curtis, Kirby and Spence were keenly examining crops of all kinds for insect foes, as is evidenced by their standard work, a very text-book of economic entomology.† These observers were acquainted with the Hessian Fly, as they allude to it, but they make no mention of its having been found in England. Since Kirby and Spence and Curtis, there have been close observers, notably Miss Ormerod, who has been working indefatigably in this field for at least twenty years, and by whom such an attack as that of the Hessian Fly would have been discovered upon its earliest appearance.

In 1779 there was a great scare concerning this insect in England, and the public mind was greatly exercised. The Privy Council consulted Sir Joseph Banks, the then President of the Royal Society, and prohibited the introduction of wheat from America for a time, until it was ascertained that the insect, which was termed the "flying weevil," as may be seen in the records of the Privy Council Office, was not the Hessian Fly. From this it may be supposed that, not only at that time, but long afterwards, the attention of entomologists and farmers was directed to the discovery of this insect, of whose depredations in America such evil reports had crossed the Atlantic. In short, all the circumstances, and indeed all the evidence, tend to prove that it has only been a short time in this country, and in all probability not long before 1886.

No fresh light has been thrown upon the mode of its introduction into Great Britain, and the conjectures that were made upon its first appearance, to the effect that it was brought from America with straw used for packing goods, must still be hazarded. There is certainly some reason for this, since the first outbreak in England was noticed upon Revell's Hall Farm near Hertford, to which quantities of manure from stables and cow-sheds in London had been brought. The straw in which goods are packed would naturally find its way to the stables and cow-shed near the depôts to which they were consigned. At the same time it must not be forgotten that an outbreak was reported at Inverness, in Scotland, just after that at Revell's Hall, though it is as likely that infested straw might have been brought to Inverness with goods in the same way as to London. Straw does not come in bulk from the United States; but it is imported from France, Belgium, and Holland, which have not been suffering from the attack of the insect in recent years.

* 'Farm Insects.' By J. Curtis. 1859.

† 'The Introduction to Entomology.' By W. Kirby and W. Spence. 7th edit. p. 91.

Miss Ormerod instituted a careful examination at the port of Hull of all the straw imported there, for some months in the spring of this year. The search was conducted by a careful agent, but no pupa-cases were found.

Pupa-cases were found in abundance in the "tail" corn and siftings after infested corn plants were threshed, during last winter. It is therefore possible that pupa-cases brought to Great Britain with imported tail corn, or thin and refuse corn for feeding, imperfectly cleaned, may have been the origin of the attack in this country. It does not appear that such common corn is imported from the United States, as it would hardly pay for the freightage; but it is sent from Odessa and other Black Sea ports and from Baltic ports, and sold to farmers, chicken fanciers, and pig keepers, and is distributed over the country. Pupa-cases may very easily have been distributed in this way with the feed corn from Russia, which country has only been infested since 1879, and it is far more likely to have originated from that source than from America. The circumstances in connection with the importation of corn of all kinds from America are the same as they have been for many years; if these were favourable to the introduction of the insect into Great Britain it would surely have appeared here long ago. Seeing that the insect was discovered in this country so soon after its arrival in Russia, it may be concluded that it came over in some way from Russia. And this is strengthened by the belief that is now expressed by entomologists, that the parasites which have been found in the pupa-cases of the Hessian Fly are of Russian and not of American origin; or that those in Great Britain belong to the same species as those of Russia and differ from the American parasites.* The distinction between these parasites is pointed out later on.

The line of march in the progress of the insect in Great Britain during the last two years is somewhat remarkable, inasmuch as it is almost entirely confined to the eastern part of the country, and generally not far from the sea-coast. In Scotland the whole of the eastern sea-board from Berwick to Ross and Cromarty is infested, in some places very slightly, in others more seriously. This has given rise to an idea that the flies may have been brought by the wind from infested countries across the sea, and, alighting on the eastern shores, may have made their way inland. From whence were they wafted in this case? The nearest countries are not infested. Russia is the nearest country in which the insect has been known to be present in

* Professor Riley, the United States entomologist, while in England lately, examined specimens of the parasites found in the pupa-cases of the Hessian Fly, and pronounced them to be different from those known in America.

recent years, but it seems impossible that such tiny flies could be carried so far by the wind. Curtis was of opinion that the turnip saw-fly, *Athalia spinarum*, "might have been transported to our shores by the winds setting in from Norway, Holland, or France." * Curtis also quotes Mr. Marshall, a careful observer, who calculated that "the turnip saw-flies might be transported from the southern cape of Norway to the coast of Norfolk in ten hours, and as they can live five or six days without food they could cross from the most eastern confines of Russia probably before they were exhausted." The turnip saw-fly is a much larger and stouter insect than the Hessian Fly, and has a considerably longer life. It may perhaps appear absurd to entertain the notion that the Hessian Fly is wind-borne, but it must not be forgotten that the prevailing wind in Great Britain in the spring is from the east, generated in the Arctic Ocean, and passing through Russia.

The annexed table shows the counties in England which are known to be infested, the districts or parishes in which the insect has been discovered, and the extent of the injury occasioned by it.

TABLE I.

Name of County.	District or Parish infested.	Extent of Injury.
Bedfordshire ..	Ampthill, Dunstable, Houghton Regis, Potton, Sandy, Woburn	Considerable in places.
Berkshire	Basildon	Slight.
Buckinghamshire	Stony Stratford	Very slight.
Cambridgeshire ..	Duxford, Foulmire, Long Stanton, Meldreth, Royston, Steeple Morden, Trumpington, Willingham	Not much injury, but a general attack in these parishes.
Essex	Great Wakering, Halstead ..	Slight.
Hampshire	Lymington, Petersfield	Very slight.
Hertfordshire ..	Buntingford, Hertford, Hoddesdon, Ware	Serious, especially at Hertford.
Huntingdonshire ..	Offord d'Arcy, St. Ives	Slight.
Kent	Halstead, Higham	Very slight.
Lincolnshire	Ancaster, Billingboro', Deeping, Donington, Grimsby, Sleaford	Somewhat serious, particularly near Grimsby.
Norfolk	Long Stratton, Morningthorpe, Threxton	Not much injury.
Northamptonshire	Kettering, Sutton, Wansford ..	Not serious.
Northumberland ..	Alnwick, Belford	Slight.
Nottinghamshire ..	Newark	Slight.
Oxfordshire	Goring Heath	Very slight.
Somersetshire ..	Bridgwater	Very slight.
Suffolk	Long Melford, Sudbury	Slight.
Wiltshire	Downton	Slight.
Worcestershire ..	Malvern, Redditch	Slight.
Yorkshire	Goole, Hull, Holderness	Serious in places.

* *Op. cit.*

It will be seen that there are twenty English counties in which the presence of the Hessian Fly has been demonstrated. Of these Hertfordshire has decidedly suffered the most, and Cambridgeshire comes next in point of the serious consequences of the attack, though the greatest amount of injury caused on one farm was in the East Riding of Yorkshire. In several instances where the extent of injury is stated as slight, it was found that only a few pupa-cases were found here and there.

With respect to the situation of these twenty counties, a glance at the map will show that those which are the most seriously attacked lie to the east of the country.

In Table II. the affected counties of Scotland are shown to be as follows :—

TABLE II.

Name of County.	District or Parish infested.	Extent of Injury.
Aberdeenshire ..	Springhill, Inverary, and very general near sea-coast	Somewhat general, but injury not very great.
Banffshire	In many parishes near sea ..	Not very serious.
Berwickshire ..	Bilsdean, Cockburnspath	Not very serious.
Elgin	.. .. ..	Slight.
Fifeshire	.. .. ..	Slight.
Forfarshire	Arbroath, Brechin, Meigle, Montrose	Serious and extensive.
Haddingtonshire ..	Drem, Dunbar	Not very serious.
Kincardineshire ..	Bervie, and other places near sea	Slight.
Ross-shire	Cromarty, Nigg, and places near sea	Somewhat extensive.
Perthshire	Crieff, Errol, Pitcour	Serious.

Reference to the map of Scotland will show that all the infested counties are in the east of the country; also that all of them have an extensive sea-board, except Perthshire, and this county is connected closely with the North Sea by the Firth of Tay. Miss Ormerod has made special enquiries as to Caithness, and it seems that the pupa-cases have not yet been found there, or in Sutherlandshire.

As concerns the life-history of the Hessian Fly, but little more has been verified than has already appeared in the Journal.* The perfect insect, that is, the fly, has been bred in confinement by Miss Ormerod, by myself, and by several other persons, and has been proved to be identical with the American species, as described by Mr. Fitch, Professor Riley, Dr. Packard, and other American entomologists, as well as with the species described by Dr. Lindeman as infesting the Russian corn-fields.† Its manner of egg-laying has been witnessed by

* 'Journal,' 2nd Series, vol. xxii. pp. 721 *et seq.*, in which descriptions and illustrations of the insect are given by Miss E. Ormerod, and Mr. Whitehead.

† 'Die Hessen Fliege in Russland.' Von Dr. K. Lindeman. Moscow, 1887.

Mr. Taylor, of Errol, who was fortunate enough to be able to watch a female deposit eggs upon a wheat-plant under glass. Mr. Taylor gives the following description of this:—"The fly goes about egg-laying in a business-like manner, with its head towards the point of the blade and the ovipositor extended in a kind of semi-circle to reach the conical surface of the blade. After it has laid one egg it takes a flight round the blade and alights again at almost the same place to repeat the operation, until a row of very minute specks of a vermilion colour is laid along the centre of the blade. I could not say that it laid more than two eggs at a time, without a change of position, nor how many it laid." This corresponds with the account of oviposition in America, given by Professor Cook as quoted by Dr. Packard, and by Professor Riley. Dr. Lindeman's story of the egg-laying in Russia is much the same as that told in England and America. He says, however, that the eggs are glued together by a sticky substance and laid in little heaps of five to eight on the leaf. Each female lays 230 eggs, according to Dr. Lindeman, who calculates that, allowing a proportion of half as males, one female in a year would be the progenitrix of 30,180,750 individuals.*

No observations have been made with regard to the larvæ of the autumn generation. These have not been discovered upon the wheat plants in the autumn. Larvæ were found by Mr. Palmer upon barley-plants in the first week in July, together with pupa-cases. These resembled the descriptions of entomologists of the larvæ of the Hessian Fly in America, as well as those in Russia given by Dr. Lindeman: though it should be noticed that Dr. Lindeman states that the larva has ten pairs of spiracles, and Professor Riley, writing of the American larva, avers that it has nine pairs. The larvæ seen by myself were just on the point of changing into pupæ, but their identity was unmistakable.

Dr. Lindeman has given a most interesting account of the larva, as seen by him in Russia, with more details as to this state than have been noted previously. The mouth is described as a tiny cut, or rent, on the under surface of the head-segment. Round the mouth there are chitinous coverings, plates of mail. It is also furnished with an instrument evidently adapted for boring holes in the tissues of the corn-stems.

As to the injury caused by the larvæ, whose term of active injurious existence is not more than from 30 to 33 days, it seems disproportionate, and cannot be solely from their absorption of the sap of the plants. For instance, there may only be

* *Op. cit.*

two pupa-cases found in the joint of one stem of a plant, and no indications that any other parts of it have been attacked. Yet the stem itself is shortened and bent down, and its ear comparatively empty, and the whole plant is less vigorous than those near and uninfested. This was more plainly shown this season upon barley-plants than upon wheat-plants, though in the latter there was a clear difference upon close observation. Dr. Lindeman considers that the simple exhaustion of sap and the local irritation set up by the larvæ are not sufficient by themselves to occasion the mischief, and suggests that the larva secretes poisonous matter which permeates the whole system of the infested plant and injuriously affects it. In this view he is supported by Dr. Cohn.

Concerning the pupa-cases, or puparia, in this country, nothing more is known than has been published by Miss Ormerod, and by the Agricultural Department of the Privy Council. Their development in confinement, that is, in artificial conditions, is most uncertain and irregular, and cannot be accepted as positive proof of habit in a natural state. In some instances the fly in confinement came from the pupa-case in the late autumn in about 15 days. In others the change to the fly form did not take place until the spring; the pupa remained unchanged throughout the winter, though the temperature was maintained at an equable autumn and spring point. That some of the pupæ of the spring generation do not change in the autumn while in a natural state, is quite clear, because the pupa-cases were found last winter upon self-sown corn-plants, and those carried with corn in the straw to ricks and barns remained perforce in a state of hibernation. This, however, does not affect their vitality, as such pupa-cases taken from tail corn in February produced flies in confinement. Obviously it is difficult, or, at least, it requires patient watching to witness the emerging of the flies from the pupa-cases in the fields, and no accurate information is yet available upon this point. It is hoped that in time, this and other results of continuous observation may be forthcoming.

There is nothing definitely settled as to the number of the generations of the Hessian Fly in England, though it is generally accepted that there are two, as in America; namely, that which comes forth in the autumn and infests the "fall" wheat, and that which appears in the spring and attacks both wheat- and barley-plants. Dr. Lindeman is of opinion that there are three generations in Mid-Russia, and even four in a district of Southern Russia.* It is assumed, however, that there is not a

* *Op. cit.*

regular succession of generations, three in the one case and four in the other, but that the intermediate generations are irregular and fortuitous. Nor are these intermediate generations of much consequence to crops, as at the time of their development the straw is hard and cannot be attacked, though they probably serve to carry on the continuity of existence upon self-sown plants, or seedlings. Of course it is possible that the recurring generations described by Dr. Lindeman may be simply due to the retarded development of individuals, which is exemplified in the case of puparia in confinement.

If it is considered that sound deductions cannot be drawn from such artificial circumstances, it may be urged that retardation of development is common in most insects, and is a provision of nature to prevent the extinction of a species by sudden or extraordinary climatal changes or other catastrophes. The natural, or normal, period of the existence of the Hessian Fly is about 48 days, according to the experience of entomologists in America and Russia. But between the egg-laying in the spring, which takes place immediately after the fly comes from the pupa-case, and the appearance of the fly in the autumn, there are far more than 48 days. It may be accepted as a fact that the spring generation is not evolved at the same time; that there is not, in short, a general flight from the pupa-cases. Nor does the autumn generation by any means appear in its winged form simultaneously. There would seem to be no reason why there should not be a supply of winged individuals of retarded development throughout the season, and this may easily be mistaken for distinct generations. In the course of time this will be accurately ascertained. It is not considered important from an agricultural point of view, as tending to make the Hessian Fly more dangerous and destructive, whether there are more than two generations in a year. After all, the generations to be feared by agriculturists are, that which is heralded by the fly in autumn when the wheat is just up, and that of the spring when the barley is just springing.

When the Hessian Fly was first discovered, some farmers suggested that its presence should not be made known, as it might hinder the sale of their produce. This idea was quickly dispelled, and farmers have been very ready to furnish full particulars. The Commissioners appointed by the Government had not the least difficulty in getting information concerning it from them, and they seem willing to adopt any practical measures of prevention that may be advised.

As to measures of prevention, not very much that is new has been recommended since those put forth by Miss Ormerod, and by the Agricultural Department, which naturally are those

which have been found efficacious in the United States, *mutatis mutandis*, and are for the most part simple and easily adopted. The first and most obvious of these is to cut the infested corn-plants above the second joints by setting the machines high, in order that the pupa-cases may be left on the stubble. Immediately after harvest, the land should be ploughed, the plough having a skim-coulter, so as to bury all the stubble. Or, the land may be broad-shared, scarified, or cultivated, and the stubble collected carefully and burnt. Ploughing is by far the safer method. Where clovers, sainfoin, or artificial grasses have been sown on the corn, the only possible means of prevention, short of ploughing in everything, "seeds" and all, is to brush off the stubble with blunt scythes, or poles, and collect it and burn it. Should the infestation be very serious, it would be desirable to plough the "seeds" in together with the stubble. In districts where destruction had been extensive, farmers might combine to sacrifice "seeds" in this way, and to carry out other methods that had been useful elsewhere in stamping out the insect. In Russia, the stubble is ploughed in where seeds have not been sown, and, as Dr. Lindeman observes, the farmers naturally object to plough up "seeds" which would spoil the course of husbandry. Dr. Lindeman says that on a farm in Russia a field of rye was so infested and injured, that the plants were rolled down and ploughed in. Burning stubble is not practised in Russia; it is not recommended by Dr. Lindeman.

Late sowing winter, or fall, wheat, that the plants may not be above ground until the autumn generation of flies has been exhausted, is a most important method of prevention. Though on some soils this means a diminution of the crop, and might even mean the enforced sowing of spring wheat, it would be well worth the sacrifice in very bad cases of infestation. This is practised in the United States very frequently, and Dr. Lindeman holds that the late sowing of winter corn in Russia would be the best means of stopping the spread of the insect. He states that he advocated this in Russia in 1880, and that it was adopted by many farmers.*

But with this late sowing of autumn wheat there must be a complete freedom from self-sown corn-plants in adjacent fields and on the outsides of fields. This is also insisted upon by Dr. Lindeman, as it is clear that these plants would serve as media for carrying on the winter generation until the spring. These can be destroyed absolutely in ordinary stubbles by ploughing. In "seeds" the self-sown corn-plants must be fed off with sheep,

* *Op. cit.*

or brushed off with the stubble. A few of these self-sown corn-plants, called "volunteer" in America, may serve to infest a whole district; therefore it is of little use taking steps to destroy stubble unless self-sown corn-plants are eradicated at the same time.

Here it will be convenient to remark that rye is subject to the attack of the Hessian Fly in America and in Russia. From this it may be reasonably inferred that it will infest rye-plants in Great Britain. Rye is sown very early in the autumn for horse-food in the spring, and sometimes for ewes and lambs. It would be very dangerous to sow rye in the vicinity of infested fields, as the plants would serve to carry on the insect throughout the winter. Though it has not been found upon rye-plants in this country, there is a strong presumption that it would be harboured upon them, and due precaution should be taken. The same remarks apply to winter barley for early food for ewes and lambs and other sheep, which is put in generally at the end of August, thus affording a suitable host for the eggs of the insect. If winter barley is sown in infested localities, it is of no use postponing the sowing of wheat.

Many pupa-cases have been seen among the cleanings, cavings, and short refuse straw, after thrashing and dressing infested wheat and barley. From some of these, kept in glass bottles, flies have come, and in the greater part of the pupa-cases the pupæ appeared to have full vitality, though they had been in ricks upon the straw from August until March. In threshing and cleaning wheat and barley from fields known to have been infested, or from fields near to those infested, close examination of the refuse from the threshing and dressing machine should be made. In the event of pupa-cases being found, all this should be at once burnt. Straw from infested fields should be stacked as closely as possible and used only for litter, and in the winter months. In the recommendations published by the Agricultural Department it is also urged that if wheat and barley upon the straw of which pupa-cases are discovered, are threshed out in the fields, infinite care should be taken to destroy all the cleanings and cavings, and to stack the straw tightly together, or remove it at once and use it for litter. When ricks are made near fields, their outsides should be trimmed with shears according to the practice of neat farmers, and the short straws burnt.

Where wheat-plants show symptoms of failing and of losing plant in the late autumn and winter, they should be examined. If larvæ, or pupa-cases, are seen, it would be well to put sheep upon the wheat as soon as possible in the spring, that they may

eat it down close and thus effectually clear off the insects. This is practised with advantage in America, but it appears that sheep are put on in November sometimes there, which would not answer in this country.

Miss Ormerod has suggested that dressings of lime, soot, or salt, might be efficacious if applied to infested wheat-plants in the winter, and to barley-plants in the spring. A particular mixture of quicklime, gas-lime, soot, and sulphur is recommended as likely to check the insect in the larval state. Dressings are occasionally used in America and with some benefit, as Packard says, who adds, "It is evident that such remedies as these should be applied before the insect transforms into the flax-seed state, as the hard dense pupa-case is impervious to ordinary appliances such as would kill the maggots"* (larvæ). Dressings put on to destroy the larvæ would at the same time give the plants a stimulus, and enable them to resist these enemies. Nitrate of soda, guano, or sulphate of ammonia, might be employed to dress infested wheat- and barley-plants with advantage, since, as already stated, it has been noticed that the plants upon poor places in fields, and upon banks, felt the effects of the attack of the Hessian Fly more than those upon good soil where the plants were stronger and more vigorous.

These methods of prevention and remedies which have been cited would have considerable influence in lessening the gravity of an attack if they were promptly employed, and if the farmers in infested districts would agree to act together to carry them out. By some persons (not, it must be said, by farmers) it was held that the Government should step in and obtain compulsory powers to try to stamp out the insect, and to award compensation for losses sustained in the adoption of drastic measures. Practical men agree that this action would have been enormously costly and well-nigh impossible, and that no more could have been done by the Government than was done. This was confirmed by Professor Riley, the United States entomologist, who came over in September to the Meeting of the British Association, and was much pleased with the action of the Agricultural Department in circulating information throughout the country. Not more than this was done in the United States, whose Agricultural Department is the most energetic and best equipped in the world; nor in Russia, with its autocratically paternal government, except that meetings of farmers were convened in some districts to discuss methods of prevention.

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* *Op. cit.*

Nature has provided the most effectual means of preventing the Hessian Fly in the shape of other insects parasitic upon and destructive to it at certain stages of its life.

Many other insects injurious to agricultural crops are providentially held in check by other insects which prey upon them, either as parasites like the *Platygaster tipulæ* and *Macroglenes penetrans*,—tiny flies which infest the dangerous Wheat Midge, *Cecidomyia tritici*—and *Pachymerus calcitrator*, so effective in lessening the numbers of the Corn Saw-Fly, *Cephus pygmæus*, that has been very prevalent in wheat-plants and barley-plants in this last summer. The dreaded Hop Aphis, and other Aphides peculiar to crops, are devoured wholesale by the familiar "Ladybird," *Coccinella punctata*, and its larva, termed "nigger" in the hop country because of its colour and ugliness. Butterflies, and moths of all kinds, are particularly liable to the attacks of their peculiar parasites. And the parasite of the Hessian Fly, a tiny fly itself, has accompanied it, and has emerged from its pupa-case, after having spoiled the Egyptian.

Of this there is no doubt, though as to the species of this parasite there is some doubt. It has not yet been clearly defined whether it belongs to the special parasites of the Hessian Fly in the United States, or to those in Russia. It has been declared by some to be *Semiotellus destructor*; but Professor Riley, to whom a specimen was submitted, believed it to be *Merisus intermedius*, Lindeman, rather than *Semiotellus destructor*, Say. Another specimen, said to be *Semiotellus destructor*, was considered to be a new species of Thomson's *Isocyrtus*. Professor Riley was of opinion that none of the specimens were from America.

This is a very strong argument in favour of the idea that the Hessian Fly was introduced into England from Russia, rather than from America. But it requires a specialist to determine the exact species of these tiny parasites; the examination of Professor Riley was necessarily cursory, and made with a pocket lens, so that it may turn out that the parasites are American after all.* Specimens, however, have been sent to Mr. Howard, of the United States Department of Agriculture, whose determination is awaited with great interest. Dr. Lindeman concludes an interesting paper upon the parasites of the Hessian Fly, by remarking that the general result of his work will show that the larvæ of the *Cecidomyia destructor* are liable to be attacked by the same genus of Pteromali in America and in Russia,

* Since this was written, Professor Riley, in conversation with the writer, has expressed his strong belief that the parasites are Russian.

but that the species differ in each country, as shown by the following Table * :—

Larvæ are infested in America by :—	Larvæ are infested in Russia by :—
Merisus destructor. Say.	Merisus intermedius. Lindeman.
Merisus subapterus. Riley.	Tetrastichus Rileyi. Lindeman.
Tetrastichus productus. Riley.	Eupelmus Koeschii. Lindeman.
Eupelmus alynii. French.	Platygaster minutus. Lindeman.
Platygaster Herrickii. Packard.	Semiotellus nigripes. Lindeman.
	Euryscapus saltator. Lindeman.
	Platygaster (?)

It remains a moot point, then, as to whether the parasites of the Hessian Fly in Great Britain are of American or Russian origin. This will probably soon be cleared up. That there are parasites present, and that they destroy the Hessian Fly is perfectly clear, and there is every reason to believe that they will be as useful in checking its increase as in America. As far back as 1841 Herrick stated that a very large proportion, probably more than nine-tenths, of every generation of the Hessian Fly is destroyed by parasites.† Packard quotes a statement to the effect that "the Hessian Fly was nearly exterminated in Kalamazoo county by the *Semiotellus* (*Merisus*) *destructor* (Say), nearly all the 'flax-seeds' having been destroyed by the friendly parasite." ‡ This appears to be the most destructive of all the American parasites, and as it is much like the Russian species, *Merisus intermedius* (Lindeman), found in Great Britain, both in appearance and in its habits, it is desirable to give its *modus operandi* as described by Professor Riley. He says that the "eggs of this parasite are without much doubt deposited in the half-grown larvæ of the Hessian Fly early in the spring, and in the more southern portions of the wheat belt there are, in all probability, two generations, the first issuing from the puparium in April and May, and the second issuing all through the summer and fall. Many, judging from my own experience in-doors, hibernate in the pupa state within the Cecidomyid puparium, and cut their way out in the following spring. In the north, however, there seems to be but one generation." §

Semiotellus (*Merisus*) *destructor*, as shown at Fig. I. on p. 447, is only about the eighth part of an inch long, with a wing expanse

* 'Die Pteromalinen der Hessen Fliege.' Von Prof. K. Lindeman.

† 'A brief preliminary note of the Hessian Fly and its Parasites,' by Edward C. Herrick. American Journal of Arts. 1841.

‡ *Op. cit.*

§ 'On the Parasites of the Hessian Fly,' by C. V. Riley. Proceedings of United States National Museum, vol. viii. No. 27. 1885.

of a fourth of an inch. It is black, with yellow colourings on the tibiæ, tarsi, and antennæ. There is a dark-green metallic tinge upon the head and thorax. The wings are fringed; the veins of the wings are distinct, and dark brown in colour. According to the careful comparative description of Lindeman of this insect with the Russian species, termed by him *Merisus intermedius*, there are clear differences of colour and specific difference in the antennæ of the two species.*

Fig. I.—*Semiotellus* (*Merisus*) *destructor.* Say.

Insect magnified. Lines showing natural size.

Professor Riley describes four other kinds of parasites upon the Hessian Fly in America. Of these the most important is the *Platygaster Herrickii*, shown in Fig. II. (p. 448), whose method of attack is different from that of the *Semiotellus*, inasmuch as it deposits its eggs within the eggs of the Hessian Fly. Packard remarks upon this, and quotes Herrick's account of the process. "I first saw it, September 23, 1833, in the act of depositing its eggs in the eggs of the Hessian Fly. From subsequent observation it appears that five or six eggs are laid in a single egg of the Hessian Fly. The latter egg hatches, and the animal advances to the pupa state as usual, but from the puparium no Hessian Fly comes forth." † Professor Riley, it is fair to say, does not accept this without verification.

The *Platygaster Herrickii* is about the same size as the *Semiotellus*, shining black in colour, with brown tibiæ and tarsi. The wings are fringed but have no venation.

Dr. Lindeman has found a species of *Platygaster* in Russia, named by him *Platygaster minutus*. It is smaller than *Platygaster Herrickii*, and has yellow tarsi and tibiæ, and does not lay its eggs in the eggs, but in the larvæ of the Hessian Fly.†

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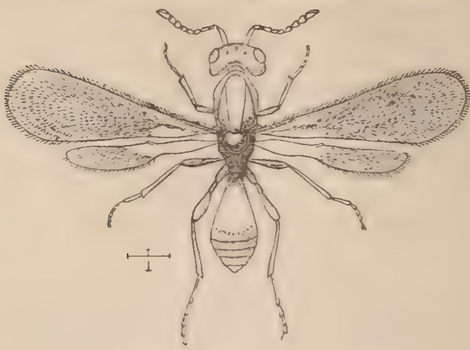
* 'Die Pteromalinen der Hessen Fliege,' von Professor K. Lindeman. 1886.
† *Op. cit.*

Fig. II.—*Platygaster Herrickii.* Packard.



Insect magnified. Lines showing natural size.

Concerning the parasites of the Hessian Fly, erroneous ideas have been formed and promulgated in the newspapers. The principal of these is that no measures should be employed to check its progress, because at the same time the parasites would also be checked or destroyed. This means that we are to allow the insect to multiply without taking any action, and to trust to the parasites to rid us of the pest. This is not advocated by American authorities, with their long experience of nearly one hundred years. On the contrary, it is shown by the reports of Fitch, Packard, and Riley, that in some seasons the parasites are few and far between, from certain causes, climatal in all probability, and are perfectly unable to cope with and stay the increase of the insects. Packard, speaking of the "periodicity" in the abundance and scarcity of the Hessian Fly in the United States, observes that "this is due to the influence of the weather, of favourable and unfavourable seasons, and partly, in most cases, to the absence or abundance of the insect parasites, although the latter cause is largely influenced by climatic agencies." It might happen that if the farmers in Great Britain were unwise enough to put implicit faith in the parasites and allow the Hessian Fly to breed without let or hindrance, a season would come in which they would find that they had trusted to a mere broken reed. Hop planters have been advised to let alone their Aphis-infested hop-plants, and not wash them with soft soap or quassia, as this would kill or drive away the ladybirds, *Coccinellæ*, from their hunting-grounds. Those who have taken this advice have frequently found too late that the ladybirds have been of no avail against the quickly generated hosts of Aphides which have ultimately ruined their crops. The Chalcid parasites, in short, are most useful allies against the Hessian Fly, but must

not be depended upon to fight against it alone. If there were no parasites, it would be necessary to import some, if possible—to "colonise" them, as the American entomologists term it—but, fortunately, they have come over with the enemy, and all due and proper care must be taken of them.

No one can foretell the course of the Hessian Fly in this country, whether the climate will be suitable for its increase, as in America and Russia, or whether other conditions will be favourable to its development. From the greater amount of winter cold in both those countries it might be supposed that the climate of Great Britain would be more suitable for the insect. According to the American entomologists, damp, mild seasons conduce to its spread, but frosts of the most severe character do not affect it. In Russia Dr. Lindeman noticed that heavy rains were most injurious to the Fly in the autumn. Though there had been a serious attack in Pultowa in the spring of 1886, the flies were completely cleared away by the continuous rains at the end of the summer. Professor Riley expresses the opinion that the Hessian Fly will not prove a very serious plague to British Agriculturists. The Professor has had more experience upon this subject than any man living, and we can only hope that his prediction may be confirmed.

XXI.—*Report of Experimental Work on Protective Inoculation for Anthrax and Quarter Ill.* By WILLIAM ROBERTSON, Principal of, and JOHN PENBERTHY, Professor of Therapeutics at the Royal Veterinary College.

IN obedience to instructions received from the Veterinary Committee of the Society, we have been engaged in experimental inquiries into Protective Inoculation for Anthrax aud Quarter Ill, and, acting on the suggestion of the Committee, our efforts have been principally directed to providing means of protective inoculation against Quarter Ill, and with the view of testing the statements regarding the efficacy of Pasteur's preventive for Anthrax.

The commencement of this work was, we regret to say, much delayed by the tedious process of obtaining a licence from the Government to carry out such part as was deemed purely experimental; four months having elapsed between the dates of application for and receipt of the official permission.

In further detailing what has been done, we will relate first what pertains to Anthrax—or Splenic fever—and to the employ-

ment as a preventive for the disease of the Pasteurian prepared "vaccine."

On October 13th, 1886, some tubes of Anthrax vaccine were obtained from M. Pasteur's agent in Paris. On the same day the specified dose of "premier vaccin" was injected into the subcutaneous tissue of two young bullocks at the College.

Up to the 24th there was no appreciable systemic disturbance. The temperature remained normal. At this date each animal was inoculated with the prescribed dose of "deuxième vaccin." As little disturbance followed this latter part of the operation as was noticeable after the former. (It should be mentioned that two inoculations, with an interval of ten days between each, are deemed necessary for the provision of protection.) This vaccine, microscopically examined and cultivated, was found to contain the anthrax bacillus. At the time of the last protective inoculation a small quantity of "deuxième vaccin" was injected into a rabbit and guinea-pig. On the following day both these small creatures were found very unwell. Sixty-four hours after inoculation the guinea-pig was found dead, and 108 hours after inoculation the rabbit. The blood of both contained anthrax bacilli in considerable numbers. A yellow mouse, inoculated with a drop of blood from the dead guinea-pig, died in 36 hours.

Cultivation with blood from these several sources verify the statement that in Pasteur's "deuxième vaccin" there are bacilli capable of killing the rabbit, guinea-pig, and mouse, but which in due time, after inoculation with "premier vaccin," have no deleterious effect on young bovines.

We now experienced some difficulty in obtaining unattenuated virus from a naturally contracted case of anthrax. It was not till November 29th that we received from Dartford an affected spleen, about the condition of which for experiment there might be some doubt. Its virulence was, however, proved by inoculation of a rabbit, which died 21 hours after, its blood swarming with the anthrax bacilli. Cultivation yielded a fine growth in 24 hours, some of which injected into another rabbit induced death in 32 hours.

On December 10th, some viscera were obtained from another fatal case of anthrax in a bullock. Microscopic examination of spleen pulp showed anthrax bacilli in large numbers. It was decided to use this as a test. About 30 drops of a mixture of spleen pulp and distilled water, were injected into the subcutaneous tissue of one of the oxen "protected" with Pasteur's vaccine, and of an ox which had not been so protected. There was no appreciable general indisposition in either case. The

REGISTER of TEMPERATURES of TWO CALVES INOCULATED with VIRULENT ANTHRAX MATTER, DECEMBER 10TH, 1886.

Dates.	"Vaccinated."	Not "Vaccinated."		"Vaccinated."	Not "Vaccinated."
1886.	Fahr.	Fahr.	1886	Fahr.	Fahr.
10, at 9.30 P.M.	101·6	102·7	Dec. 18, at 5. 5 P.M.	102·1	103·1
11 „ 9.30 A.M.	105·1	103	„ 19 „ 1. 0 A.M.	102·3	101·5
11 „ 3.50 P.M.	106·8	106	„ 19 „ 9.15 A.M.	103·1	101·1
12 „ 12.50 A.M.	105·8	107·3	„ 19 „ 11.30 P.M.	102·2	102·2
12 „ 10.40 A.M.	102·2	106·4	„ 20 „ 9.35 A.M.	100·6	101
12 „ 3.10 P.M.	102·2	106·1	„ 20 „ 5.20 P.M.	102	100·5
13 „ 9.55 A.M.	102·6	105	„ 21 „ 9.30 A.M.	101·2	102
13 „ 4. 5 P.M.	103·3	105·2	„ 21 „ 4. 5 P.M.	102·2	103
14 „ 12. 5 A.M.	103·2	103·8	„ 22 „ 9.50 A.M.	100·6	102·3
14 „ 9.30 A.M.	103·2	102·5	„ 22 „ 4.30 P.M.	102·8	104
14 „ 4. 5 P.M.	103·6	105·2	„ 23 „ 9. 0 A.M.	102·2	102·5
15 „ 12. 5 A.M.	103·6	107·6	„ 23 „ 5. 0 P.M.	101·4	101·4
15 „ 9.30 A.M.	103·7	106·5	„ 24 „ 4. 0 P.M.	102·0	103·4
15 „ 5.35 P.M.	102·5	107·6	„ 25	103·0	102
16 „ 9. 0 A.M.	101·8	103·3*	„ 26	103·2	102·6
16 „ 12. 5 A.M.	Not taken.	106·7*	„ 27	102·4	103·6
16 „ 5.30 P.M.	102·5	105·7	„ 28	103·8	101·4
17 „ 12.40 A.M.	103·5	107	„ 29	102	101·4
17 „ 9.45 A.M.	102·5	105·2	„ 30	102·4	102·4
17 „ 3.45 P.M.	103	103·7	„ 31	101·3	102·3
18 „ 12.20 A.M.	102·8	103·6	Taken several days after this; no appreciable variation.		
18 „ 10. 0 A.M.	102·4	103·1			

thermometer, however, showed a very high temperature in the unprotected animal, remaining with slight variation up to near 107 till the 16th. That of the "protected" animal, it will be seen, became elevated on the day following the injection to 106·8, after which it almost immediately receded to normal.

At the same time, and with the same material, a rabbit was inoculated in the subcutaneous tissue of the abdomen. Up to the night of the 13th, there was no evidence of systemic disturbance, but at 5 A.M. on the 14th, 85 hours after inoculation, it died. Its blood swarmed with anthrax bacilli.

On January 28th, 1887, an outbreak of anthrax of a most viru-

REGISTER of TEMPERATURES of CALF VACCINATED OCTOBER 13TH, 1886, and INOCULATED with VIRULENT ANTHRAX BLOOD, JANUARY 28TH, 1887.

Dates.	Fahr.	Dates.	Fahr.
1887.		1887.	
Jan. 29, at 9.45 A.M. ..	105·8	Jan. 30, at 11.45 P.M. ..	104·3
„ 29 „ 4.30 P.M. ..	106·7	„ 31 „ 9.45 A.M. ..	102·4
„ 29 „ 9.45 P.M. ..	105	„ 31 „ 11.55 P.M. ..	103·3
„ 30 „ 9.45 A.M. ..	103·6	Feb. 1 „ 10.10 A.M. ..	102·5
„ 30 „ 5. 0 P.M. ..	104·1		

lent type occurred at Chelmsford, in which 46 adult cattle died within a few hours. Being personally engaged in the investigation of this matter, we selected some material from a case most rapidly fatal. The same night we injected 30 drops of a mixture of spleen pulp and distilled water into the remaining ox, which had been "protected" with Pasteur's vaccine. Beyond the fact that the temperature rose on the following day to 106° F., and a little swelling at the point of inoculation, there was nothing worthy of remark till February 13th, when an abscess was noticed at the seat of previous swelling. This became very large—much pus escaping on its being opened. There was no bovine or other large susceptible animal at hand which could be used as a control. A rabbit, however, subjected to the same test showed much swelling at seat of inoculation, and died of typical anthrax in 78 hours.

The foregoing cannot be regarded as absolute and in itself sufficient proof of the protective power of M. Pasteur's vaccine, though whatever demonstration there may exist, it is certainly favourable to it.

Taking into consideration the expressed desire of the Veterinary Committee of the Society, and the means at our disposal, it was deemed unadvisable to prosecute this matter farther.

The apparatus essential to the production of the "vaccine" by Pasteur's method is now in working order at the College, and can be utilized for the purpose at the Society's pleasure; but in view of the limited nature of outbreaks of the disease in Great Britain, it will in all probability be more economical to obtain the necessary protective material direct from M. Pasteur's laboratory in Paris, should such be required.

The disease technically known as "Symptomatic Anthrax," "Charbon Symptomatique," &c., has in different localities in this country received various appellations, as "Quarter Ill," "Black Quarter," "Black Leg," "Strike," "Felling," "Irons," "Puck," &c., most of which are in some way significant of its more manifest characteristics. Its distribution throughout Great Britain is general, and the national loss from its ravages considerable. On many farms the annual average has been computed at from 5 to 10 per cent. Essentially a malady of young stock (here, at least, particularly cattle), its effects are most marked in breeding and rearing districts.

Its more prominent features may be summarized as follows:—Its ordinary subjects are young cattle with ages ranging from six months to two years. Animals above and below this age seem to enjoy a large share of immunity. The attack is sudden, and the course usually rapid and fatal. Lameness and crepitating

swelling of some parts of the limbs or trunk, the first manifestations, generally terminate in death in from seven to fifty hours. On removal of the skin covering the swelling, the underlying tissues are found very dark in colour, and on being cut into, much serosity exudes. The rapidity of its course, and the remarkable change in structure referred to, have caused Quarter Ill to be commonly mistaken for and confounded with "Anthrax" proper. Though contagious, and belonging to the same class, the essential features of the two diseases are absolutely distinctive. Both are induced only by the entrance of minute organisms (bacilli) into the healthy body.

The bacillus to which Quarter Ill is attributed is stouter than that of Anthrax, and rounded at its extremities. The anthrax bacillus requires the presence of oxygen for the manifestation of its vital phenomena, and when viewed under the microscope, shows no motion of its own. The Quarter-Ill bacillus, on the contrary, appears to move freely in the field of the microscope, and does not require oxygen in its medium of support and development. Experiment goes to prove that this gas is highly deleterious to it, muscle-juice on being exposed to atmospheric air for some time becoming free from the organism.

While the bacillus of Anthrax shows a great selective affinity for the blood of its victim, it being usually found there in large numbers soon after death, and the blood most virulent, the blood from an animal dead of Quarter Ill is free of its bacilli, or contains them only in nearly unappreciable quantity, and is innocuous when inoculated in considerable amount. Examination and cultivation, however, demonstrate the constancy of the Quarter-Ill bacillus in affected muscle.

Klein * asserts that injection of the bacilli of Quarter Ill into the subcutaneous tissue of guinea-pigs, rabbits, sheep, and calves, *always* proves fatal. Our experiments appear to prove that this statement in general is not consistent, while inoculations into the rabbit show that animal to be in a special degree refractory to the effect of the bacilli. Injection of blood containing the anthrax bacilli into rabbits is in the large majority of instances fatal.

Though aware of certain positive statements regarding the possibility of producing the disease by infection or inoculation, as the fact was not generally appreciated, and as previously published experiments appear to have been carried out with virulent matter obtained direct from France, we deemed it expedient at the outset to direct our attention to this point.

In reply to advertisement, we received on the 3rd of November,

* Klein's 'Micro-organisms and Disease,' 1885.

1886, the first reliable material (some fresh muscle-juice) from a naturally contracted case, and expeditiously despatched in bulk to us, by Mr. Clark, M.R.C.V.S., of Horncastle. Examination showed the characteristic bacilli.

At 3.45 P.M., one drop of muscle-juice was injected into the subcutaneous tissue of each of two guinea-pigs. Five drops from the same source were injected into the muscles of the haunch of a young bullock of about ten months.

At 6 A.M. on the 4th, one guinea-pig was ill, the parts about the seat of inoculation showing characteristic emphysematous swelling; at 4 P.M., the same conditions were manifest in the other guinea-pig. At 10 A.M. (4th), the bullock's health appeared much disturbed, temperature 105·7, the limb much swollen. A course typical of Quarter Ill terminated fatally in case of one guinea-pig 18½ hours after inoculation, of the other guinea-pig in 36 hours, and of the young bullock in 57½ hours. Post-mortem examination revealed positive evidence of the disease.

Microscopic inspection and sowings of both blood and muscle-juice from each of the above cases were made. In no instance could bacilli be detected in the blood, while in variable numbers they were always seen in muscle-juice. Cultivation of muscle-juice in veal broth never failed to yield growths of characteristic bacilli. Sowings of blood under same circumstances were invariably sterile.

With muscle-juice from another very malignant case reported to us on November 11th we inoculated two guinea-pigs, which died respectively 34 and 84 hours after inoculation. Soon after death of that which survived only 34 hours, two other guinea-pigs were inoculated with its blood. These animals seemed to suffer little or no inconvenience, and lived under our observation for two months.

Cultivations of serosity taken from the above young bullock 12 hours prior to death (from Quarter Ill) by puncturing with a glass pipette showed bacillar growth in 24 hours similar to that of muscle-juice of guinea-pigs inoculated at the same time. The spores were, however, very numerous. Inoculation of rabbits with this material did not produce the disease.

The point of inoculability of the disease, and its identity with that described by Continental writers, appear from the foregoing to be satisfactorily established.

Our investigations into methods for obtaining protection from the disease have been prosecuted on principles enunciated by three eminent French veterinary surgeons, MM. Arloing, Cornevin and Thomas, of the Lyons Veterinary School, in a work published in 1883. These *savans* describe measures,

all of which they state to be effectual in inducing a state of immunity, by the introduction into the healthy animal of the virus in its natural state or in a state of attenuation.

Discarding the others as less practical, we have directed our experiments mainly to two plans apparently more easy of application in this country. From public report it would appear that in France "vaccination" for Quarter Ill is chiefly carried out (and this extensively) by introduction of dried muscle-juice into the subcutaneous tissue. The great advantages claimed for this method over most others are that the material ready for use may at any time be obtained by the veterinary surgeon, and that in its proper use there is not the slightest danger to the vaccinated animal. The "vaccin" is in France now regarded as an article of commerce, and having first ascertained by letters from M. Arloing that M. Fromage of Paris was his agent for the sale of it, we obtained from this source a supply of material. Through the kindness of C. De Murrieta, Esq., of Wadhurst Park, Sussex, who, in August, 1886, wrote expressing his great interest in the matter, and generously placed some of his young stock at our disposal, we were enabled to commence testing the efficacy of Arloing's dried muscle-juice.

On August 21st, Professor Penberthy proceeeded to Wadhurst Park, and carried out the first part of the process of protective inoculation by injecting into the subcutaneous tissue of the tails of six young beasts (carefully marked for distinction) a few drops of a solution in pure water of Arloing's prepared muscle-juice subjected to a temperature of 100° C. After an interval of ten days, Professor Robertson proceeded to Wadhurst Park and completed the process by injection in the same situation of the vaccine No. 2, which is dried muscle-juice subjected to a temperature of 85° C.

These animals were then, with six others unprotected, placed in a pasture traditionally notorious for the fatalities from Black Quarter occurring in it. Notwithstanding the assurances of the attendants acquainted with the place, that some, if not all, would be attacked, two months elapsed without the slightest appreciable change in the animals, save a little soreness at the seat of inoculation. Temperatures regularly taken and carefully registered by Mr. Chapman, agent at Wadhurst, showed little variation.

It was determined to test further the efficacy of this operation by introduction of muscle-juice from a naturally contracted case. The first opportunity occurred on November 30th, on receipt of some muscle forwarded by Major Percy, of Hodnet, and said by him to have been taken from a typical case. A considerable quantity (4 cc.) of expressed muscle-juice was injected into

the thighs of each of three vaccinated and three unvaccinated calves. Save slight lameness of two of the animals (one vaccinated and one unvaccinated), they appeared to remain in perfect health, the thermometer indicating normal temperature for six following days.

On January 7th, 1887, Mr. Couchman, V.S., of Wadhurst, telegraphed that he had met with a marked case of Quarter Ill in a young bull still alive, and within two miles of Wadhurst Park. On the 8th, Mr. Penberthy proceeded by early train to the spot, recognized a clear case, obtained the necessary material from the affected muscles of the bull, which had died 18 hours previously, and injected 5 cc. into the thigh of each of the so far untested experimental animals, *i.e.* three vaccinated and three unvaccinated. Strangely enough, with the exception of a considerable local swelling in one of the vaccinated calves at the seat of inoculation, and the elevation of its temperature on the following morning to 106·2°, there was no disturbance. The temperature of this animal dropped by degrees daily to normal.

On return to College, a guinea-pig was inoculated with one drop of muscle-juice, and three rabbits with three drops each. The rabbits suffered no ill-effects, while the guinea-pig died of Quarter Ill in 28½ hours. The principal inference from this experiment, one item of which entailed four journeys into the middle of Sussex, appears to be evidence in direction of the view that circumstances may materially modify the infecting power of the virus, or the susceptibility of the animal. To the fact of a mild attack of the naturally contracted disease establishing protection we shall again refer. In absence of satisfactory elucidation of the reason we must, at least for the time, be content to accept it as an axiom that extrinsic and intrinsic conditions affecting the animal, and probably the virus, obtain to a greater extent in this than in many other contagious diseases. This bears out the result of clinical observation generally as to its erratic occurrence.

In order to give another trial to M. Arloing's "vaccine" powder, a fresh quantity was obtained from his agents in Paris, and on January 18th at the College, a heifer and steer, each about 10 months old, and a guinea-pig, were vaccinated in accordance with the directions with the powder. After the prescribed interval the process was completed. Careful observation revealed no disturbance from the operation.

On February 3rd, Mr. Godman of Woldingfold, Horsham, with whom we were previously in communication, wrote saying that one of his heifers was attacked with Quarter Ill, and that he wished the remainder of his young stock "protected." Ac-

cordingly, on the following morning, Mr. Penberthy proceeded to Woldingfold, and "vaccinated" twenty-three animals with Arloing's No. 1 vaccine, intending to go down and finish the process in due course. The case of the heifer was characteristic, and some muscle-juice containing the virus in considerable numbers was used to test the effect of the powder on the vaccinated steer and heifer at the College, and on a guinea-pig. In the case of the cattle a few drops were injected at 8.35 P.M. into the thigh of each, and one drop into the subcutaneous tissue of the guinea-pig. On the following morning the animals were noticeably ill. Symptoms of acute Quarter Ill developed; the guinea-pig died 24½ hours, the steer 44½ hours, and the heifer 47 hours after inoculation. The following chart shows temperatures at:—

4th Feb. 1887.	Steer.	Heifer.
9 A.M.	104·3 Fahr.	105·6 Fahr.
2 P.M.	102·3 „	106·4 „
9·30 P.M. ..	101·5 „	102·2 „

Post-mortem examination revealed typical Quarter Ill. After this, with the concurrence of Mr. Godman, it was decided that the remainder of the process of vaccination by Arloing's powder method should not be carried out on the 23 calves.

At the same time that the heifer, steer, and guinea-pig were vaccinated with Arloing's powder, we inoculated another guinea-pig with muscle-juice dried at 32° C. prepared by ourselves. This little animal was subjected to precisely the same condition of inoculation of virulent material from Godman's case as the calves and a guinea-pig, and experienced no ill-effect, living apparently in perfect health for two months after.

This latter circumstance induced us to make further trials of material prepared on the principle of the last mentioned. Muscle-juice was dried and subjected to various temperatures. On February 14th, six guinea-pigs were vaccinated, three with powder produced at a temperature of 32° C., and three with some produced at 39° C. Forty-eight hours after inoculation one of the latter died, and 98 hours after one of those inoculated with 32° C. powder.

On February 25th and March 7th, three fresh guinea-pigs were vaccinated with Arloing's powder.

Up to the latter date the four surviving inoculated guinea-pigs appeared perfectly well. On the morning of the 8th of March one was found dead, which was inoculated with 32° C. material on February 14th,—one which had been inoculated and, as above, resisted virulent injection. One by one they were found dead, until by the 4th of April the whole of our experi-

mental animals had succumbed. During the occurrence of this mortality there was great variation of atmospheric temperature, in addition to which we now have reason for supposing there was neglect on the part of the special attendant, who was discharged at this date. Post-mortem examination yielded no evidence of Quarter Ill.

These accidents were of course disastrous to this aspect of our work, which there had been reason for hoping might yield some practical result. We may, however, learn from it that three out of four guinea-pigs which had been inoculated with muscle-juice dried at 32° C., and two out of three inoculated with muscle-juice dried at 39° C., survived without manifesting ill-effects. It is also remarkable that one guinea-pig inoculated with muscle-juice dried at 32° C. suffered no inconvenience from injection of virulent matter, which killed two calves and a guinea-pig " vaccinated " with Arloing's powder.

It should perhaps be mentioned here that the French experimenters first dry the muscle-juice at 32° C., and then submit it —mixed with water—for some hours to dry heat of 100° C., and 85° C., respectively for " first and second vaccines." The effect of the high temperature is probably the attenuation of the virus. It seems to us highly probable that the system of the calf would resist the injurious effects of a more potent virus than that in use in the form of M. Arloing's powder, and that a more potent virus would be more likely to make a protective impression on its subject. We therefore think it desirable that further investigation into this matter should be prosecuted.

Another phase of the disease is very interesting, and partly depending on it is the basis of another system of protective inoculation. The virus when introduced in moderate quantities (a fraction of which into the muscles would be fatal) into the blood stream of a susceptible animal, is incapable of inducing the affection. It has been asserted, by the writers before referred to, that introduction of fresh virus into the blood current of the living animal does not induce the disease, but that it actually confers on the animal so treated immunity for periods ranging from one to two years.

Experiment on this system was rendered practicable by the magnanimous offer of Major Algernon Heber Percy, of Hodnet Hall, Shropshire, who communicated to us an expression of his great interest in the work in hand, and volunteered to provide the necessary animals and attention for carrying out a series of trials on this special point at his farm adjoining Hodnet Hall. The offer was cordially accepted, and the necessary preliminary arrangements made. Commencement of operations depended no the occurrence of a typical case of Quarter Ill at or near

Hodnet. The opportunity arose on November 11th, when, in response to a telegram from Major Percy, Mr. Penberthy proceeded to Hodnet the same night. On arrival it was found that the animal which was to provide the protective material had died at 11.45 A.M. Major Percy, with the kind assistance of his neighbours, Viscount Hill, Sir Vincent Corbett, Sir Thomas Meyrick, Mr. J. Tayleur, Mr. J. Bibby, and Rev. J. Hill, had collected early in November eight calves of different sizes, and of ages varying from 6 to 10 months. They had for some days been grazing together, and were now placed at our disposal for the experiment. It was decided that four of these animals should be protected by intravenous injection and placed with the remaining four; the whole to be subject, save for inoculation, to precisely same conditions. To facilitate reference, the calves were marked and known as 1, 2, 3 and 4, and A, B, C and D.

On the morning of November 12th, a large number of agriculturists, veterinary surgeons and others had assembled to witness the operation. Examination of the dead calf revealed a clear case of Quarter Ill, apparently free from putrefactive change. Pieces of muscle from the most affected part were then taken and the juice obtained by squeezing through coarse linen. After diluting with water, the material for inoculation was ready. Calf No. 1 was then cast and secured with ropes, the jugular vein laid bare by dissection, and with the utmost precaution, to avoid contaminating the connective tissues, a few drops of the diluted muscle-juice were injected into the blood stream by means of a very fine hypodermic syringe. No. 2 was treated in the same way. In the case of Nos. 3 and 4, the material was introduced into the jugular vein by passing the hypodermic syringe point directly into it through the skin without previous dissection. Duly marked for identification, the eight calves were turned into a pasture and treated in every way alike, except that the temperatures of the inoculated were taken twice daily for eleven days. The register on page 460 shows that the heat-regulating functions were scarcely noticeably disturbed. The thermometry was undertaken by Major Percy, who personally superintended it, and Mr. Tomes, bailiff, who evinced the greatest care and interest throughout, states that up to the 24th all the calves appeared perfectly well.

It was previously arranged that at the expiration of seven days the virtue of this intravenous inoculation should be tested by injection into the muscles of virulent matter obtained from a naturally occurring case of Quarter Ill; the whole eight being subjected to the same treatment. To obtain the fresh virus for this purpose we put ourselves in communication with several stock-owners and veterinary surgeons. On receipt of

Register of Temperatures of Four Calves, Inoculated with Quarter Ill by Intravenous Injection.

(Inoculated November 12th, 1886, 11.30 a.m.)

Calves	Nov. 12th.	Nov. 13th.		Nov. 14th.		Nov. 15th.		Nov. 16th.		Nov. 17th.		Nov. 18th.		Nov. 19th.		Nov. 20th.		Nov. 21st.		Nov. 22nd.		Nov. 23rd.		Nov. 24th.		Nov. 25th.
No.	4.30 P.M.	9.30 A.M.	3.10 P.M.	9.45 A.M.	4.10 P.M.	9.30 A.M.	4.0 P.M.	10.0 A.M.	3.35 P.M.	11.0 A.M.	4.10 P.M.	Noon	3.40 P.M.	7.30 A.M.	3.50 P.M.	7.30 A.M.	3.45 P.M.	7.25 A.M.	4.30 P.M.	7.30 A.M.	4.40 P.M.	7.35 A.M.	3.45 P.M.	7.25 A.M.	4.30 P.M.	10.45 A.M.
1	102·2	103·2	102·6	101·4	103·0	102·6	102·8	103·0	103·4	103·4	103·0	101·6	102·2	102·2	104·6	104·0	103·2	103·6	103·8	103·6	103·8	103·0	103·0	104·0	103·0	103·8
2	102·0	102·4	103·6	102·0	103·0	102·6	103·2	102·2	103·4	102·0	103·0	103·2	103·0	103·2	104·0	102·4	103·2	103·4	103·0	102·8	103·2	103·0	102·4	103·0	103·4	103·4
3	103·0	102·6	102·4	102·4	102·0	102·2	103·0	102·4	102·4	103·0	103·0	103·0	103·4	102·4	103·6	102·6	103·0	102·0	102·2	102·0	102·2	102·6	103·0	103·0	102·2	102·8
4	102·4	101·8	103·4	101·4	102·2	102·2	102·0	101·6	102·2	102·4	102·4	103·4	103·4	103·4	103·0	103·4	103·2	102·0	102·6	102·2	102·4	103·0	102·0	103·6	103·4	103·0

a telegram advising us of a case in the practice of Mr. Brett, M.R.C.V.S. of Mansfield, on November 23rd, Mr. Penberthy proceeded thither, informing Major Percy that he expected to be able to apply the test at Hodnet Hall on the following day. On arrival at Mansfield the animal was still alive and suffering from Quarter Ill; but this being of a mild type and not likely to die immediately, we deemed it not quite satisfactory for so crucial a test. We determined to utilize this case for another purpose, and communicated our intention to Major Percy. By a happy coincidence preliminary signs of the disease were noticed in a heifer at a farm near Hodnet Hall, and being made aware of this fact by telegram, Mr. Penberthy started from Nottingham for Hodnet immediately. On arrival it was announced that, in addition to the heifer referred to, one of the experimental animals (uninoculated) A. was noticed lame at 4.30 P.M.; at 9.30 P.M. we found it obviously dying of Quarter Ill. Next morning at 6.30, A. was dead and cold, and at 11.20 A.M. the heifer first seized died.

At 12 noon on the same day, in presence of a large number of gentlemen interested, the majority of whom had witnessed the inoculation on November 12th, Professor Penberthy injected, with all antiseptic precautions, into the subcutaneous tissue of the limbs of the remaining seven calves, a considerable quantity of virulent matter taken from the muscles of the still warm heifer. The seven were then placed and kept together in a meadow, under identical conditions. The table on page 462 is a register of the temperature taken twice daily.

It will be borne in mind that A. uninoculated had died of the disease naturally contracted while grazing with the others.

On the early morning of the 26th, C. was found so lame of the right hind limb that it could not walk. D. also was lame of the right hind limb.

At 9 A.M. of the 27th, C. died, and Major Percy writes: "C. was opened in presence of several friends, and was proved to be a bad case of 'striking'" (Quarter Ill), "spreading in all directions from point of inoculation."

On the 28th D. appeared very stiff in both hind limbs, mostly the left; he died at 10 A.M. on the 29th, and was opened in the presence of several farmers, and was also a clear case of "striking," spreading on both sides from the point of inoculation.

On the 28th a crepitating swelling was noticed on B.'s side at seat of inoculation; she appeared very dull and unwell. On the 29th a "lump" was found at the above-named spot, and she was very unwell. On November 30th the swelling was hard and much more defined. It gradually softened on the subsequent days, the calf returning to a state of health.

REGISTER OF TEMPERATURES OF SEVEN CALVES INOCULATED IN TISSUE.

(INOCULATED NOVEMBER 25TH, 1886, 12 NOON.)

Calves.	Nov. 25th.		26th.		27th.		28th.		29th.		30th.		Dec. 1st.		2nd.		3rd.	4th.	5th.	6th.	7th.	8th.
No.	Noon. Inoculated.	3.45 P.M.	10.0 A.M.	3.35 P.M.	12 noon.	5 P.M.	7.44 A.M.	3.40 P.M.	7.35 A.M.	5.45 P.M.	10 A.M.	3.15 P.M.	4.35 A.M.	5.45 P.M.	7.25 A.M.	4.40 P.M.	7 A.M.					
1	Behind Left Fore Elbow.	103·2	103·2	102·2	102·4	102·6	103·2	102·6	103	102·8	103·4	103	103·6	102·6	103·6	102	103	Registration not continued.				
2	Left Thigh.	103	103·2	102·4	103	103·2	103·2	102·8	104	103	103·6	102·6	103·4	103	103·4	103·2	103·4					
3	Left Shoulder.	102·2	103	102·2	102·6	102·2	103·2	102·8	103	102·4	103·8	102·8	102·8	102	103·2	102·4	103·2					
4	Right Hind Thigh.	102·8	102·6	102·2	102	102·2	103	102	103·2	102·2	102·8	102·4	102·4	102·4	103	103	102·4					
A.	Died of the naturally contracted disease on November 24th.																					
B.	Left Fore Shoulder.	102·4	103·6	102·6	103·8	104·2	103·8	104·6	104·6	103·4	104	102	103·4	102·6	103·6	102·8	103·8	103·4	103·4	103·4	102·8	103·6
C.	Right Hind Thigh.	102·8	105	104·4	Died at 9 A.M. November 27th.																	
D.	Right Hind Thigh.	103	104·6	105·2	105·6	106	107·4	104·8	104·6	Died at 10 A.M. November 29th.												

Of those inoculated intravenously on November 12th, *i.e.* Nos. 1, 2, 3 and 4, neither has appeared to suffer in the slightest degree. Of the four unprotected, one A. died of the disease taken naturally while grazing with the others; two, C. and D., died of the disease produced by the test inoculation on the 25th; and one, B., through contracting the disease from the test inoculation, survived in a manner we have frequently had occasion to notice. It was suggested to Major Percy that after perfect recovery B. should again be inoculated with virulent matter, with a view of ascertaining how far his mild attack had afforded him immunity, as it is usual for mild or resisted attacks of such diseases to act in this fashion; but it was decided that it could not be conveniently carried out.

However, to test this view, we utilized the mild case previously referred to as occurring near Nottingham. On December 29th, after perfect recovery of the bullock, sixty minims of muscle-juice taken fresh from a fatal case of Quarter Ill were injected into its thigh. Following this there was little general and no appreciable local disturbance. The temperature four hours after the operation rose to 104·2, in eighteen hours it became normal, and from this time the animal fattened rapidly.

Simultaneously with the bullock, two guinea-pigs were inoculated each with two drops of muscle-juice from the same source, and died within 25 hours, post-mortem examination revealing conditions characteristic of Quarter Ill.

In order to prove the practicability of the intravenous method of protective inoculation on December 22nd, Professor Penberthy, with aid of Mr. Tomes, the bailiff, inoculated 24 young cattle at Hodnet Hall. On this occasion, the injection was done in every case by piercing direct through the skin into the vein. The injected virus was taken from a heifer which had died some hours previously. The operation lasted about 1 hour 20 minutes. There was, Major Percy states, no sign of indisposition in the animals after the inoculation, and up to the date of writing this report there has been no case of Quarter Ill amongst these calves.

It may be interesting to add here the statement that each of the seven animals which died during the carrying out of the experiments at Hodnet Hall had been duly setoned and drenched.

The practical outcome of this work appears to us to be that it has made clear the fact of the communicability by inoculation of the disease known in England as Quarter Ill, and its identity with that spoken of by both Arloing, Cornevin and Thomas as "Charbon Symptomatique." Without further proof of its

efficacy, we cannot recommend the use of Arloing's dried muscle-juice as a means of protecting cattle from the disease in Great Britain.

The simplicity of the method of inoculation described, as well as its general practicability, favours its adoption. Inasmuch as some of our experimental guinea-pigs, after being "vaccinated" with muscle-juice subjected to the effect of a lower temperature, resisted the influence of injected virulent matter, some of which killed cattle and other guinea-pigs vaccinated with Arloing's powder, further experiment in this direction should be made. In such case, and indeed in all, the result is likely to be incomparably more valuable and trustworthy if experiment for protection be made with animals of the class for which practical protection is sought.

The Hodnet Hall experiments go very far to prove that the intravenous injection of considerable quantities of fresh virus is protective, and to a large extent practicable. The greatest drawback to its general adoption seems to be the necessity for fresh material with which to inoculate. This difficulty is not really as great as at first sight may appear. It at least has this in its favour, that it presupposes the existence of the disease on the estate, and does not encourage the chance of introducing fresh disease from without, as is probably the case with some systems of inoculation.

Resulting from the publication of a report of the experiments at Hodnet by Major Percy, several stock owners have applied to us to have their animals protected by the intravenous method. In view of the results already obtained, we strongly advise the further and fuller adoption of this plan.

In concluding our Report, we must again acknowledge our indebtedness to Mr. C. De Murrieta for placing animals and services at our disposal; to Major Percy, whose untiring interest in the whole matter and great solicitude for the proper observance of all details in connection with the Hodnet experiments have had no small share in the attainment of their success; to Messrs. Bennett, Pyatt, Kettle and Barron, veterinary surgeons, who, together with other gentlemen before referred to, have rendered material assistance.

After the above Report was written, one lot of 53 animals, belonging to Lord Egerton of Tatton, were inoculated, after the manner described in the Hodnet Hall experiments, with the virulent matter of Quarter Ill, taken from an animal of the herd which died on the spot after the arrival of Mr. Pen-

berthy. Of this number, 4 animals died of Quarter Ill, and another subsequently, though not of the same disease.

Such an untoward result may, it is hoped, be guarded against by greater experience in the manipulatory work.—W. R.

XXII.—*Twenty Years' Changes in our Foreign Meat Supplies.* By Major P. G. Craigie, Secretary of the Central Chamber of Agriculture.

No single feature of our times is more prominent than the growth of international relations and international competition, and no one is perhaps more thoroughly convinced of this, for no one has felt some of the consequences more severely, than the British farmer of 1887. Food it is still as imperative as ever for our fellow-subjects to find, but world-wide is now the field whence it comes to our markets. If therefore it was once the duty and the interest of the farmer to acquaint himself betimes with what his neighbours were producing around him, it is not less wise for him to ask to-day what is going on in more distant climes, and in what precise particulars and from what special quarters he must look for the keenest competition. The meat producer as well as the wheat grower has in these times to keep his eye on the foreign horizon, and he is entitled to claim the fullest possible information as to the varying course and current of the daily stream of competition from abroad. Some day perhaps the English, like other governments, may deem it their duty not only to collect, but to digest and explain for the farmer's benefit all the facts and figures of the ever-changing situation. Till our Agricultural Office, still in embryo, is thus fully equipped for service with an "Intelligence Department" of its own, it cannot be amiss for private and unofficial observers to offer for the guidance of producers such notes as they may gather, either from a study of the records of our own and other governments, or from the parallel researches of foreign writers.

At no time has the question of our meat supply been neglected in the columns of this Journal. Many warnings have been given of new competitive developments, and many incentives offered to fresh exertions to meet the ever-growing demands of one of the most densely peopled and most conspicuously meat-eating populations of the globe. Fifteen years ago, in a valuable article which has formed a storehouse of information, and a basis for many statistical enquiries into the limits of our own

production, the late Sir Henry Thompson,* recurring to the older counsels he had offered in 1858, maintained that our grass lands "if properly managed would be easily able to meet the demand made upon them for an increased production of meat, even if the supply required were greatly in excess of the present rate of consumption." Either his advice was not taken, or his prophecy was founded on insufficient premises, or the remarkable reduction in the cost of transit and the collapse of prices generally have upset the data on which this forecast was founded. Never perhaps has the fame of England stood higher for the class of live-stock she produces. No country has furnished so large a yearly supply of meat from the stock maintained. Yet we have not by any means kept pace in this country with the additional number of mouths to be fed.

We have not even provided the additional number of pounds per head which would have sufficed for our earlier population had it remained stationary. There was, I believe, in the aggregate rather more meat produced at home in the year 1886 than was the case in 1871, but the increase is a very slight one. We are often reminded that neither the considerable extension in area of our grass lands, nor the facilities for the wider purchase of extraneous feeding stuffs, have secured for us the independence inculcated by Sir Henry Thompson's article.

In these times of trade depression, the commonest complaint of the British manufacturer is that he cannot find new markets as he once did for that which he produces. Commercial geography is his newest study, by the light of which he searches for fresh customers at the ends of the earth. Now the manufacturer of butcher's-meat, for meat-making is assuredly a manufacture, has at hand and day by day a ready-made and always extending market opened, simply in the growth of our home population. Every day that passes finds him more than one thousand new mouths to fill, if he is prepared to fill them. Surely then it is worth asking if we have reached the limit of profitable meat-making, and who are the competitive producers that step in and appropriate this spontaneously opened trade at our own doors. Eminently timely is the enquiry what are the special forms and the precise degree in which foreign meat displaces our own, and whether not the frequent and striking changes, alike in the origin, the volume, and the character of the competition, afford us any grounds to determine whether this supplanting of our produce is to go on extending or contracting, whether it is to be permanent or temporary.

In a subject so wide, and where so many figures are neces-

* 'Journal,' vol. viii., Second Series, p. 152.

sarily uncertain, I am anxious to be allowed to make it clear what is dealt with under the name of 'meat.' By this in the sense here used, I understand simply beef, mutton and pig-meat, including in the latter term, for the sake of brevity, the various forms of bacon, hams and pork, in which we consume the produce of our own or foreign swine. I am not of course unaware of the supplementary animal food which enters into our yearly consumption—the poultry, rabbits, game and eggs; perhaps also I ought to add all the fish which forms always a material part of the food of the people. Reliable data for such an extension of our enquiry do not exist, for we do not know, and have scarcely any means of estimating, our domestic production in Great Britain. In the notes, therefore, which I now offer, I confine myself to the more limited items of our meat supply, and mainly on this occasion to the dimensions and the sources, and the past fluctuations of that sea-borne portion of our yearly provision which has filled up the gap left by the apparent failure of our native production to respond to the native demand.

It will be convenient perhaps to carry the enquiry a little further back than was done in 1872, and, slightly overlapping Sir Henry Thompson's figures, to glance at the state of matters over the whole period embraced by our existing system of agricultural statistics from 1867 to 1887—a period long enough to allow of many characteristic changes in the sources of our supplies.

Twenty years ago this country had just emerged from the danger and the losses of the invasion of the fatal Rinderpest. Taught by experience, we had begun to find it wise rather to risk a possible check to the importation of living animals by sanitary regulations, than to court the insidious entrance of contagious diseases along with cattle from suspected quarters. The arrivals on our shores of cattle, sheep, and pigs, in 1867 and 1868, fell far short of some earlier records, and the dead-meat trade of the period at which I begin this survey was also at a lower level than we shall again find it in subsequent years.

It has been, I find, a very common practice simply to compare the number of head of stock imported at various dates. This information has, doubtless, its own interest, and I may have to use it in certain cases; but it may lead us wrong if we regard as equal units in our calculations imports so widely diverse as a Dutch calf and a fat American ox. I propose, therefore, wherever practicable, to translate the simple numbers into the equivalent weights of food represented, thus more readily obtaining a combined view of the live and dead meat competition at given dates. The remarkable changes, too, in the countries whence our imported live-stock come will thus be made more clearly visible, by taking into account the varying

weights of their produce. The official publication by the Agricultural Department in their 1883 Report, of the average weights of the animals arriving from different countries, enables me to make a closer estimate than if I were to assume, as in Sir Henry Thompson's paper, a mean uniform weight for all foreign cattle, sheep, or pigs, regardless of the country of origin. This explanation I must offer here, as it will account for some slight difference in the weight of imports in the years enumerated in both papers.

There is one other proviso I would make before dealing with the figures. Unquestionably certain of our live imports from what are technically known as clean countries, from Canada and from Denmark for instance, are not immediately on their arrival available as meat as here reckoned. So far as any foreign store cattle are retained for fattening, they will come into the totals of our domestic census in each month of June, and will undoubtedly cause a percentage of error and of double reckoning. The totals are not in any case considerable. The same error pervades all the earlier estimates, as well as that now offered, and in a comparative survey its importance is of less moment than at first appears. I am unaware of any sufficient data to enable me to eliminate the proportion of animals thus duplicated, or to discover the proper share of the resultant food supply which it might be said should be credited on the one hand to the foreign rearers of the lean stock, and on the other to the British finishers of the imported raw material. The task would perhaps, if attempted, suggest a far more serious, but equally impracticable, rectification on the other side of the account in respect of the imported feeding-stuffs through whose agency alone a considerable addition is undoubtedly made to the yearly out-turn of meat from the stock of the United Kingdom.

The foreign meat consumed in this country reaches us in two distinct forms, live animals and dead meat, but the ratio between the two has materially altered in the last twenty years. That is perhaps one of the first changes which will strike the investigator, and it will readily appear if the total arrivals for each year, or—as is always very much safer from a statistical point of view—for each group of consecutive years, be contrasted. Beginning with the years 1867–8–9, and proceeding to the latest completed accounts, the subjoined figures show the mean annual receipts of foreign meat in tons in each period. These it is well to compare with the mean population resident in the United Kingdom in each triennium, and this will form the first of the tables which I shall have to inflict on the readers of these pages:—

Period.	Meat from Live Animals imported.	Dead Meat imported.	Total average Yearly importation.	Percentage of Dead Meat to Total Imports.	Mean Population.	Rate per head of imported Meat.
	tons.	tons.	tons.	%	No.	lb.
Average of 1867–8–9 ..	60,300	56,500	116,800	48	30,692,000	8·5
" 1870–1–2 ..	76,500	100,000	176,500	57	31,563,000	12·5
" 1873–4–5 ..	79,700	180,100	259,800	69	32,506,000	17·9
" 1876–7–8 ..	90,400	245,900	336,300	73	33,573,000	22·4
" 1879–80–1	118,100	354,900	473,000	75	34,626,000	30·6
" 1882–3–4 ..	144,100	274,700	418,800	65	35,624,000	26·3
" 1885–6 ..	125,500	334,900	460,400	73	36,519,000	28·2

In the aggregate, therefore, the foreign meat supply has multiplied four-fold in twenty years, but that portion of it which reaches us alive has only doubled in this interval, while the dead-meat imports are six times as great as they were in 1867–9. They did not then represent one-half of what we received: now practically three pounds out of every four are thus imported.

Looking at the table as a whole, the continuous growth of imports in the three-year periods up to that ending with 1881 is sufficiently striking. From eating $8\frac{1}{2}$ lb. each of foreign meat in 1867–9, we came to eat $30\frac{1}{2}$ lb. in 1879–81. The remarkable check in the next following triennium was, it will be seen, one of dead meat only, for between 1882–4, our live imports showed a considerable increase. In the two last years the live imports receded materially, and it does not appear likely that in the current year, 1887, they will even reach the average of 1879–81, although the dead-meat trade has gone up in 1885–6 once more very nearly to the level of that period. In no single year, however, it may be remarked, since 1880, when over 517,000 tons were accounted for, has this country received so large an import of live and dead meat collectively as was then landed. It would seem as if that season saw the maximum of the dead-meat imports, although it was not till three years later, or 1883, that the largest arrivals of live animals were reported—the equivalent of 166,000 tons being imported in this form.

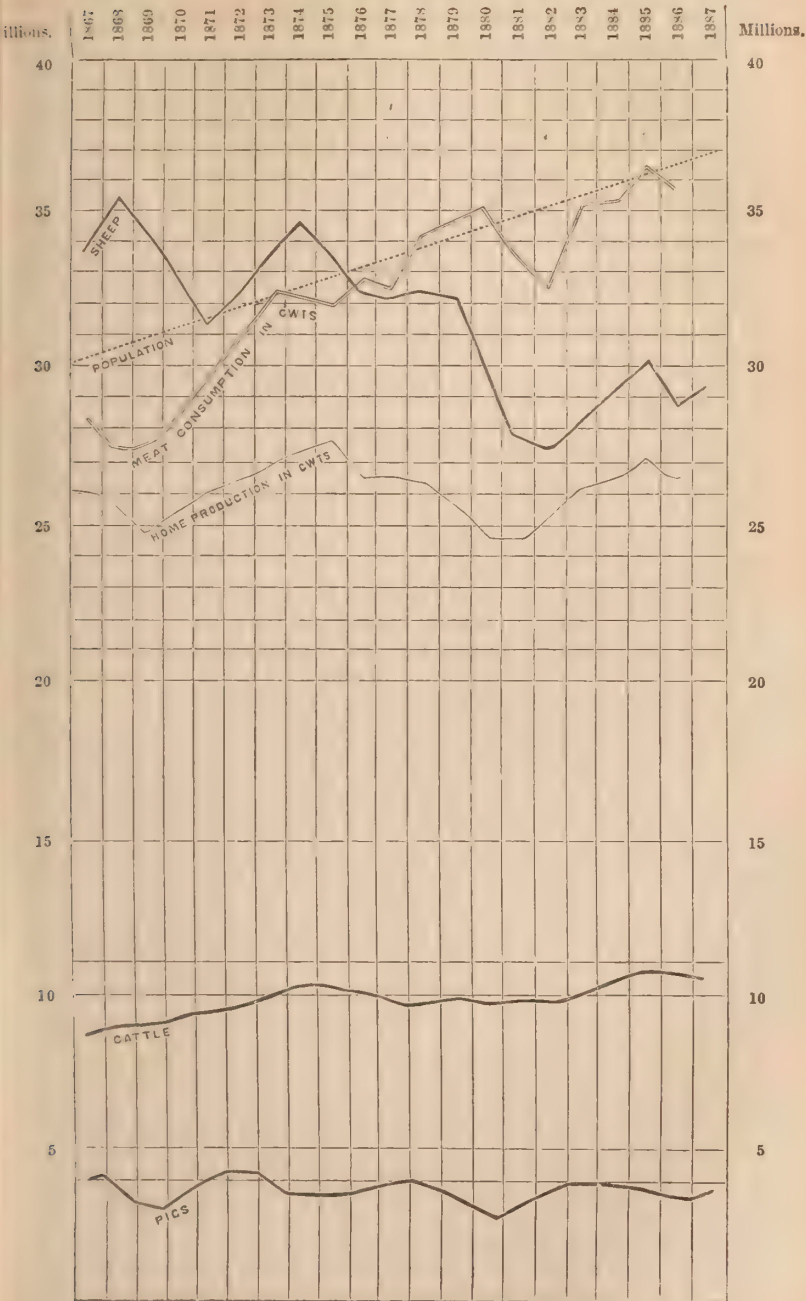
A glance at the population column of the table reminds us of the fact that in round numbers we had six millions more persons to feed at the end than at the beginning of the period under review. The diagram given on page 471 shows how far the British farmer and the foreign producer have shared the business of supplying the wants of that population.

To show the relation which our yearly imports bear to the home produce of the United Kingdom, a somewhat arbitrary

estimate of an average yearly weight of meat furnished by the herds and flocks of the country, as enumerated on each 4th of June, must be taken. I need not here remind readers of the 'Journal' that this has has often been attempted—by Mr. McCulloch, many years ago, by Sir James Caird, by Mr. J. A. Clarke, and by Mr. McDonald, as well as by Sir Henry Thompson in the paper already referred to. The full details of the latter calculation have formed the basis for many subsequent estimates—in particular for a more recent calculation which I submitted to the Economic Section of the British Association in 1884. The varying circumstances of each season must necessarily cause wide fluctuations in the meat marketed in any given year, but some mean rate of production must be assumed for any comparative enquiry such as this.

In the present calculation of home produce, I have simply used the formula enunciated by Sir Henry Thompson, with a very slight modification in the case of the number of sheep slaughtered, which I make 40 per cent., in place of 42 per cent.; but their mean weight 70 lb., in place of 60 lb. On this basis I represent by the fine line the curve of each year's aggregate annual home production (shown, for convenient comparison with the population, in cwts.) of beef, mutton, and pig-meat. The 26,000,000 cwt. of 1867 is only 26,660,000 cwt. now, and the highest out-turn was reached thirteen years ago. Adding to this yearly total the figures of our foreign imports, I obtain a second and higher curve, which represents the entire consumption of the nation. The fluctuation of this curve in relation to the line of regular progression which denotes the population of each year, shows in a clear and interesting manner what the course of meat consumption has been, while the three lines marked sheep, cattle, and pigs respectively, represent, for convenient reference, the numbers of each class of stock in the country in each year.

I may here point out that at the rate of general consumption roughly assumed to prevail in the earliest of the seven periods given in the table, it would seem that even then we were not sustaining from our own produce all our own peoplè by fully two-and-a-half million persons. It was then held, and I believe quite rightly, that something like 45,000 tons per annum of butcher's meat in all its forms was needed for the maintenance of each round million of British citizens. We may take it therefore, of course somewhat loosely, that the foreign quota of 1867–9 sufficed for 2,500,000 of the 30,700,000 persons then resident in this country. At the same head-rate of consumption, the foreign quota of 1885–6 would furnish meat not for thë new six millions only, or for that number added to the foreign-fed two-and-a-half millions of the earlier date, but for fully ten


Millions.
Millions.
1867
1868
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1887
40
35
30
25
20
15
10
5
SHEEP
POPULATION
MEAT CONSUMPTION IN CWTS
HOME PRODUCTION IN CWTS
CATTLE
PIGS

millions of souls. This is a rather remarkable discovery, since, if interpreted literally, it would mean that while we relied twenty years ago upon the foreign producer for the meat supplies of just 8 per cent. of our population, or rather less than one man in twelve, we are now relying on external aid for the supplies of over 27 per cent., or more than one man in four. There is, however, a complication which forbids us to use the figures exactly as they stand. It is not, it appears, the case that the average Briton of 1887 consumes just the same ration of meat as his predecessor of 1867. The remark is one of the most ordinary commonplace character, but the fact is indisputable. It is equally obvious to any careful observer of the social habits of all classes in the country, and to the calculator who arrives at the same result by patient arithmetical investigation. If 45,000 tons kept a million persons supplied with their average wants in the way of meat twenty years ago, I believe all the evidence points to something nearer 49,000 tons as necessary for the same purpose now. At this larger rate, perhaps we may take it without exaggeration that 9,300,000 residents in the United Kingdom are at this moment fed from the meat of other lands than ours. Our own supplies, therefore, although actually greater in bulk, do not now suffice to keep as many of Her Majesty's subjects as they did twenty years ago, and the farmer has failed from some cause or other to feed a single one of the new mouths which have opened around him.

Thus far I have spoken of imported meat without distinguishing the several varieties of form in which we consume the produce of foreign oxen, sheep, or swine. But a very little observation will make it plain that the supplies which the foreigner sends us in such abundance are not divided at all in the same proportion as is our home produce, or our ordinary consumption. The competition is consequently keener in some descriptions of meat than in others, and no enquiry will help us to understand our true position, or enable us to discover the feasibility or otherwise of any extension of our own meat manufacture, which does not attempt a closer scrutiny of the nature and sources of the competition we are striving to meet.

There is an initial difficulty in the analysis I propose, because our Customs House authorities, whose courtesy in placing official information at my disposal I am glad to acknowledge, do not in their returns distinguish between what is beef and what is mutton in the so-called unenumerated meat imports. These include the portion which comes here closed against inspection as tinned provisions.

The precise dimensions of the several classes of our import trade at the present time, and the proportion of the unenume-

rated item to the whole receipts, can best be shown by throwing into tabular form the figures for the last recorded year, 1886, in the two categories of live and dead meat, so far as officially distinguished :—

Class of Imports.	Live Animals.	Dead-meat.	Total.	Per Cent.
	tons.	tons.	tons.	
Beef	91,222	50,096	141,318	30·9
Mutton	29,673	32,614	62,287	13·6
Unenumerated (chiefly beef)	..	23,634	23,634	5·2
Pig-meat	975	228,525	229,500	50·3
Total	121,870	334,869	456,739	100·0

Such figures as these at once designate the foreign pig as by far a more formidable competitor than the foreign sheep or the foreign ox. Quite one-half of the entire import of last year and two-thirds of the whole imports of dead meat are composed in one form or another of the produce of the pig, either in the shape of bacon, hams, or pork, although it will be noticed that so far as live imports of swine are concerned, the result is a scarcely appreciable total. Such a table, too, defines the extent of our uncertainty as to the class of the "unenumerated" imports. These make but 5 per cent. of the total, and although I might perhaps have ventured, having regard to the countries whence our preserved meats come and the large proportion sent by the United States (whose exports in this form are mainly beef), to distribute this item roughly, three-fourths or even four-fifths to beef and one-fourth or one-fifth to mutton, I hesitate to do so on account of the varying ratio of the beef and mutton in this particular import in different years. Omitting for the moment this 5 per cent. of unenumerated receipts, the fluctuations of beef, mutton and pig-meat in the groups of years already referred to may be shown as follows, condensing for convenience and easy reading the figures which represent the average annual imports of each period in "thousands" of tons to one place of decimals :—

Period.	Beef.			Mutton.			Pig-meat.		
	Live.	Dead.	Total.	Live.	Dead.	Total.	Live.	Dead.	Total.
1867-8-9 ..	43·4	12·0	55·4	15·1	..	15·1	2·2	40·1	42·3
1870-1-2 ..	50·8	12·4	63·2	22·3	..	22·3	2·9	73·9	76·8
1873-4-5 ..	50·4	12·3	62·7	24·8	..	24·8	3·9	150·8	154·7
1876-7-8 ..	61·7	30·3	92·0	26·6	..	26·6	1·8	182·8	184·6
1879-80-1 ..	89·8	48·3	138·1	26·1	..	26·1	1·9	268·3	270·2
1882-3-4 ..	113·5	47·8	161·3	29·2	15·5	44·7	1·2	183·3	184·5
1885-6 ..	99·0	53·6	152·6	25·3	30·6	55·9	·9	223·3	224·2

Grouped therefore in this fashion, we avoid the excessive and to some extent accidental augmentations or declines of imports in particular years, and can read in a fairly accurate manner the changes in the aggregate supplies. Foreign beef which was once supplied us, as to four pounds out of every five, exclusively in the shape of live cattle imports, now comes to us in quantities nearly three times as great as twenty years ago, but over a third of the whole is in the form of dead meat; while if we could classify the contents of the multitudinous tins, which account for so large a proportion of the unenumerated imports excluded from the above table, we might not improbably find little short of another 20,000 tons of beef, which would bring the total up to over 170,000 tons in the latest period.

Largely as our cattle imports have lately developed, we had still at the end of last year to thank the foreigner only for the equivalent of 8½ lb. of beef per head. In bacon and pork the increase is much greater. Twenty years ago a smaller quota than of foreign beef, or somewhat below 3 lb. per head, was the contribution of the pigs of other nations to our breakfast and dinner tables. This quota of 3 lb. of foreign pig-meat has grown to nearly five times what it used to be, or to one of no less than 14 lb. per head. The recent average of 224,000 tons of pig-meat forming the last item of the above table, or the 230,000 of the single year 1886, is now very nearly ton per ton equivalent to the estimated outcome from our entire stock at home. In no other department of animal food, at all events, does the foreign farmer not merely supplement the home supply, but actually provide a nearly equal portion with our own of the entire quantity consumed on these islands.

In the last complete year, 1886, less than 1000 tons of the total pig-meat imports of 229,500 tons came in the shape of live animals, and these mainly from Holland. Another small section of fresh pork is now imported, about 4000 tons, of which practically two-thirds come from Holland, and one-third from Belgium. Of the remaining 225,000 tons, more than two-thirds were bacon, and 4 lb. out of every 5 lb. of bacon came from America, the United States sending us ten times as much as Germany or Canada. Indeed, there are but a few other countries that need be named as engaged in competition with our pig-owners, as the following rough analysis on page 475, given in thousands of tons to one place of decimals, will suffice to show.

These figures tell their own tale of whence the pig-meat comes, and of the form in which it reaches us. The past development and future prospects of the great American trade in what is called on the other side of the Atlantic "hog-pro-

Pig-meat Imported from:—	Bacon.	Hams.	Pork (salted)	Total.
	(000 omitted.)	(000 omitted.)	(000 omitted.)	(000 omitted.)
	tons.	tons.	tons.	tons.
United States	129·3	42·1	10·6	182·0
Germany	16·8	·1	1·6	18·5
Canada	9·9	4·8	·3	15·0
Denmark	6·5	·2	1·2	7·9
All other countries	·7	·1	·8	1·6
Total	163·2	47·3	14·5	225·0

ducts," although both interesting and instructive, would open too long a chapter for insertion in a general survey such as this.

In our mutton imports it must strike the enquirer how relatively little, from 1872 to 1882, the well-known decline in our home flocks apparently affected the volume of yearly imports. Little if any larger share per head of our population, even now, comes in the shape of imported live sheep. But the comparatively recent development of the frozen-mutton trade since 1882 has revolutionised our mutton imports, forming a new factor in our import-records, and in the anxieties and calculations of the flockmasters at home. There are features of much novelty in the trade, and much uncertainty in any attempt to forecast its future. The prices of the present year will, however, offer a crucial test of the possibility of large and permanent Australasian or South American imports, and the question may well form a future subject of special consideration when the results of the year are complete. Suffice it here to note, as the table on page 473 shows, that although these frozen imports have doubled themselves in the later group of years and now exceed the whole bulk of the old live-sheep trade, the entire receipts of this form of foreign mutton would not give 2 lb. per annum to each person in these islands. The whole mutton imports amount to only about a third of those of beef, and do not form a fourth part of the weight supplied by the bacon, the hams and the pork which we receive from abroad.

I would offer here some grounds for regarding as improbable any additional competition in the live-sheep trade. My reason for disregarding the prospect in this respect as a serious one to the British flockmaster arises from a consideration of the present position of the flocks of any possible competitors. Let me summarise what has happened in twenty years' time as to the sources of our live-sheep imports. Taking four illustrative dates, the sheep we imported were, in thousands (000 omitted), as follows:—

Sheep Imported from :—	1869.	1877.	1883.	1886.
	(000 omitted.)	(000 omitted.)	(000 omitted.)	(000 omitted.)
Holland	289	263	214	467
Germany	265	478	488	338
Belgium	140	61	90	3
Denmark (including Iceland) ..	4	43	125	121
Canada	..	10	94	94
United States	..	13	89	6
Other Countries	10	4	13	8
Total	708	872	1,113	1,037

The bulk of our supply thus remains of European origin. The Transatlantic supply, including both the exports of Canada and of the United States, appeared for the first time in 1876, and almost immediately reached what seems by the experience of the past decade to have been its maximum, in 1879, when 193,000 head of sheep were sent to us from the two countries, three-fifths of the whole being from the United States. The total declined to 116,000 head in 1881, but rose again, as the above table shows, to 183,000 head in 1883, when the United States took only the second place in this trade, and the traffic immediately fell off under the influence of existing prices to about one-half its former total dimensions, the export from the United States last year being quite insignificant. In the course of 1887 the collapse of this source of import seems more marked than ever. The United States did not send us so much as a single sheep in August last, or a whole thousand since the year began. The Canadian quota also was in the first eight months of 1887 but one-third of what it was in the same period of 1886.

The result will surprise no one who has noticed the position that the sheep holds in America. In the United States, in the same twenty years which have seen the marvellous development of horned stock that has covered the ranches of the West with cattle, and doubled their number in this short interval, this increase of over 100 per cent. in cattle has to be contrasted with a net gain of only about 10 per cent. in sheep. The omission of lambs from the decennial census enumeration, and their inclusion in the later figures of the Agricultural Department at Washington, have sometimes obscured this slow rate of advance. It ought not to be as little noticed as it is that since 1883 the sheep stock of the United States has declined by well-nigh 6,000,000 head. In Canada an advance, no doubt, has occurred, though its exact dimensions are not easily ascertainable on account of defective statistics at the contrasted dates; but I can bear personal testimony to the fact that one of the first features

which struck me during a visit to the Dominion three years ago was the remarkable absence of sheep. In Winnipeg I found mutton as dear as in London, and indeed both on Canadian and on American territory mutton was a somewhat rare commodity, and good mutton very much rarer. Americans confess their inability to compete with us in at least this particular, and look forward to a visit to London to enjoy a good mutton-chop.

Not from this quarter then, can I anticipate any material extension of live-sheep imports. Whatever Australia or South America may have in store for us in the way of cheap frozen mutton, their million-headed flocks are not likely to reach us alive, and if the live-sheep trade is to continue, we are practically confined to the older countries of Europe, which have all along sent us our main supply.

France was once an exporter of sheep to England. She sent 9000 head over in 1869, and once in 1872, I believe, as many as 21,800 sheep; but long before we ceased, in 1884, to take her animals at all, on account of the risk of foot-and-mouth disease, she had practically dropped out of the race. Nor can we forget that France is a far larger importer of sheep than we are ourselves. For ten years back her average imports have been twice our own, or over 2,000,000. France is so far, therefore, from being a competitor with our flocks in this country, that she is indeed the largest buyer in the European markets, besides drawing from her Algerian colonies over 600,000 head of sheep per annum. Her neighbour, Belgium, also, though of course on a smaller scale, is much more an importer than an exporter of sheep. Our Belgian imports have fluctuated much in the last 20 years. In 1876, over a quarter of a million sheep came to England under the designation at least of Belgian; in 1886, barely 2600 were so enumerated, but I believe that this trade has been largely of a transit kind, and that the ports of Belgium are only nominally the origin of the stock which passed through them from less populous districts further east.

The impossibility of distinguishing the true country of origin in the case of exports passing, for example, from Germany or Austria through Belgium or the Netherlands to England, is a matter which, with other similar defects in our knowledge of international trade, is now engaging the attention of a Committee of the International Statistical Institute, which held its first meeting at Rome in April last. Till that difficulty be solved, it is not amiss to regard as one group the sheep from Holland, Germany and Belgium in the table I have given, when it will be seen that they vary but little from 800,000 head per annum throughout the last ten years. As they form four-

fifths of our whole receipts, they leave only the Danish imports —for the arrivals from Norway and Sweden are too small to affect the supply—to exhibit any degree of expansiveness.

Denmark has indeed earned for herself an agricultural predominance among European exporters of all sorts of agricultural produce, and under her name we are receiving a considerable supply for so small a country. But it is to be remembered that no less than 31,880, or more than a fourth of her last year's sheep, were drawn, not from Denmark proper, but from that distant possession of the Danish Crown, the island of Iceland. The steady rise of Danish agricultural ability, if I may use the phrase, forbids any confident opinion that more may not be done hereafter than at present in sheep exports from Denmark, but in no case, having regard to the territory and the flocks in question, can a very serious addition to our supplies be expected from thence. And clearly, if we look further east, and trace the source of the larger part of our sheep imports to the sheep-bearing districts of Germany or Austro-Hungary, I confess I should rather expect a material reduction than an increase of competition from that quarter. A few comparative figures, illustrative of the changes which have been happening on the Continent and elsewhere in the flocks of the several nations, will explain the position, and the table on the opposite page has been compiled with this object.

Such a table, however rough the figures, which cannot be got for precisely identical years, makes one thing plain, viz., that the enumerated countries of Europe, and they include all we have to deal with, are fast retrograding in their stock of sheep. Even in these Scandinavian countries, whence, as we have seen, somewhat larger imports reach us, there is a loss of half a million head. Yet Norway and Denmark have far more sheep now per 100 inhabitants than other parts of Europe, and I question if we can go on drawing 800,000 head of sheep a year from countries which have about half the stock we ourselves possess in proportion to population,—even if it be quite true that the sheep exists less for mutton than for wool, so far as the domestic demands of the Continent are concerned. The Continental losses, it will be seen, are relatively far greater than our own; and though the precise reason of this would be an interesting question to discuss, it hardly concerns us here except to show the small chance of augmented competition.

I have omitted from my table the Southern countries of Europe, from which we draw no supplies. Russia I have included, as we got a few head of sheep from that country occasionally before 1878. Had I given the figures I have seen for Spain or for Italy, it would have appeared that heavy reductions in the flocks of each have occurred in the past twenty

SHEEP in the following COUNTRIES.

[000 omitted.]

Countries.	Year nearest to		Increase.	Decrease.	Number of Sheep to each 100 persons.	
	1867.	1887.			1867.	1887.
Great Britain ..	28,919	25,959	..	2,960	116	81
Ireland	4,826	3,378	..	1,448	88	70
United Kingdom, including Islands	33,818	29,405	..	4,413	111	79
Sweden	1,590	1,410	..	180	40	30
Norway	1,703	1,686	..	17	98	87
Denmark	1,874	1,549	..	325	102	76
Holland	1,088	753	..	335	25	18
Belgium	586	365	..	221	12	6
France	33,282	22,617	..	10,665	80	59
Germany	28,017	19,190	..	8,827	..	41
Switzerland	445	342	..	103	17	12
Austria	5,026	3,841	..	1,185	24	17
Hungary	15,077	11,184	..	3,893	98	71
Russia	42,297	46,725	4,428	..	61	58
United States ..	40,853	44,759	3,906	..	106	77
CANADA :—						
Ontario	..	1,611	..	..	..	..
Manitoba	..	13	..	..	..	..
Other provinces ..	..	1,428	..	..	..	..
Canadian Total ..	2,436	3,052	616	..	64	64
AUSTRALASIA :—						
New South Wales	11,562	39,169	27,607	..	..	..
Victoria	8,833	10,700	1,867	..	..	..
South Australia ..	3,912	6,696	2,784	..	..	..
Western Australia	538	1,809	1,271	..	..	..
Queensland	8,666	8,994	328	..	..	..
Tasmania	1,723	1,649	..	74	..	..
New Zealand ..	8,410	15,174	6,764	..	..	..
Australasian Total	43,644	84,191	40,547	..	..	..
SOUTH AMERICA :—						
Argentine	..	75,000	..	..	..	..
Uruguay	..	15,921	..	..	..	..
Falkland Islands	65	517	452	..	..	..

years. I am however so uncertain about the accuracy of the figures for the earlier years in these instances, although they appear in some of our official Blue-books, that I prefer to omit them from this survey. Spain, I believe, has not sent us any sheep for some years, and only once as many as 200 during the last twenty years. If her records, however, are correct, she has, even after a loss of 5,000,000 head, nearly 17,000,000 now, so that she has more sheep, such as they are, than Spaniards. She stands

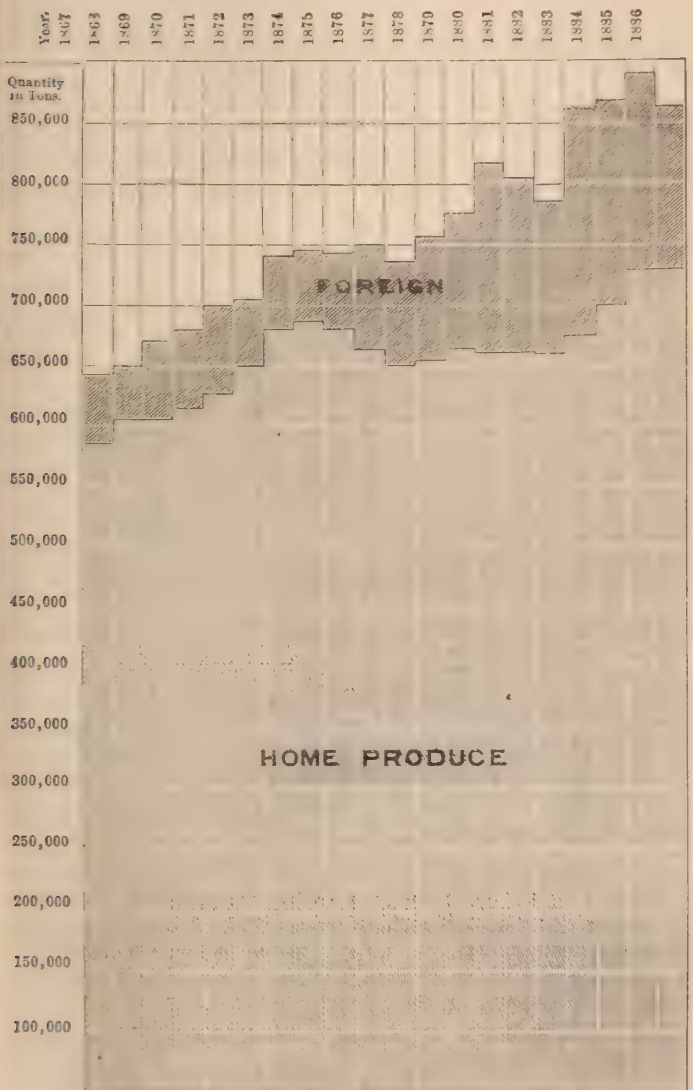
therefore higher in the scale than any other European nation, unless we were to include in our survey some of the new statelets in the south-eastern corner of the Continent. Their fleecy wealth seems really considerable. Roumania, Greece, and Servia, boast by their later returns—earlier ones, for comparison, I have not been able to find—a collective flock of nearly 9,000,000 head, and range in the order named as having respectively from 115 to 195 sheep to each 100 inhabitants. There may be a question some day of exports from this quarter of Europe, but it cannot be till the risk of importing disease as well as mutton with each cargo has departed, which now leads us to treat these territories, like the Turkish, Italian, and Russian provinces, as forbidden ground.

But if my table has one lesson in its upper portion as to the declining sources of our hitherto main import of sheep, it promptly reverses the impression by a striking picture lower down, of the enormously augmented flocks now accumulating, despite all occasional checks, in our Australasian Colonies. Even if I were to add the more doubtful figures of the diminution of sheep stocks in Spain and Italy to the scarcely disputable losses of nearly 30,000,000 head in the enumerated countries of Europe, the gigantic loss in the older portions of the world's surface would still be more than balanced by the gain in the new flocks mustering by millions annually on the other side of the Equator. The prospect, however, of increasing competition from this quarter would involve a discussion as to the permanence of the frozen or preserved mutton trade which, along with the prospects of the South American supplies, must be reserved for future consideration.

Assuming the accuracy of the estimates made as to the home produce of our cattle, the foreigner seems to grow now 16 per cent., or we may say one-sixth part, of the beef eaten on British soil. In this respect it is clear enough we are very far from realising Sir Henry Thompson's advice of 1872. The diagram on the next page will show the relative proportions of home and foreign beef on our British markets in each year of the twenty. Put broadly, the foreign supply on the average of years since 1879 would have furnished 3,000,000 British subjects with their entire meat-supply, supposing that supply to be composed of beef alone.

As we have seen, rather over one-third of the beef importation reaches us as dead meat, and rather under two-thirds comes to us alive. Previous to 1876 only about one-fifth part of the foreign beef-supply was imported dead, and up to that year, from which also we may date the starting of the American trade, the attention of our farmers here was concentrated mainly on the

HOME PRODUCE and FOREIGN IMPORTS of BEEF.



NOTE.—As explained on page 470, the estimate of each year's home produce of beef is obtained by taking one-fourth of the cattle enumerated in each year as slaughtered in the year, calculating the mean weight of each animal, including calves, at 600 lb.

living imports. Latterly their relative value as a factor in the competition has fallen off, though some of us are slow to recognize the change which, apart from its direct interest, is of indirect importance in another way, for just in proportion to this change has our freedom from imported disease increased.

Great have been the alterations in the sources of our live cattle. As in the case of sheep, I will contrast the numbers from the more important countries, omitting our imports from the Channel Islands, in the following tables, entering only for convenient reading the figures at the nearest thousands, and thus omitting "000" in each case.

Cattle Imported from:—	1869.	1877.	1883.	1886.
	(000 omitted.)	(000 omitted.)	(000 omitted.)	(000 omitted.)
Germany	83	34	28	8
Holland	62	45	39	32
France	21	3	3	..
Spain	20	27	23	8
Belgium	13	..	..	..
Portugal	9	15	22	6
Denmark	5	50	119	69
Sweden	3	5	27	13
Canada	..	8	53	67
United States	..	11	155	114
Other Countries	..	..	1	1
Total	216	198	470	318

Very significant are the changes in the origin of our imports that are shown by such a table as this. In 1869 our whole supply of cattle was European. Our more immediate neighbours, Holland, Belgium, France, Spain, and Germany, provided 199,000 out of 216,000 arrivals, or 92 per cent. of the whole. Last year only 48,000 head out of a total a third as large again, or just 15 per cent. of the importation, was drawn from the countries named. Two leading changes of current in the import of cattle have thus occurred. One is the reduction of our German and Dutch importation and the substitution of a trade with our Scandinavian neighbours, which has developed tenfold, from 8000 to 83,000 head. The second feature is the creation since 1876 of the Transatlantic trade. Nor does the alteration in mere numbers suffice to denote the change quite strongly enough. The large proportion of calves in such imports as those from Holland, and the relatively lower weights of European as compared with American stock, is not thus shown. If I convert, at the rates suggested by our Privy Council officers, the head of cattle shown above into their equivalent weight if taken for slaughter, I find that since the American

trade opened, the following are the proportions of our beef supply which came from the American Continent, from the Scandinavian countries, and from the rest of Europe respectively at the three following dates:

Live Cattle Imports.	1877.	1883.	1886.
	Tons.	Tons.	Tons.
From Canada and the United States	6,600	72,900	62,600
From Scandinavia	14,000	34,500	19,900
From the rest of Europe	28,800	25,900	8,700
Total	49,400	133,300	91,200

If I were to add in similar groups and for like years the receipts of dead meat recorded as "beef," the westward course of the centre of our foreign beef supplies would be yet more evident, and it is not difficult to do this. The beef imports so returned from the United States and Canada in the earlier of the above years exceeded 33,000 tons, while the whole import from all quarters fell short of 34,000 tons, thus leaving less than 1000 tons for the contribution of all non-American countries. In 1883 the States and Canada provided in beef, salted and fresh, more than 52,500 tons. Not 2000 tons reached us from Europe, to make up the total 54,500 for that year. Last year the European quota was much less than this, and the American total itself was lower, 48,000 tons coming from Canada and the States, with less than 400 tons from all Europe.

A new element, however, now appears, for we have no longer alone to deal with North America and with Europe, but, as in the case of mutton, with our distant Australasian Colonies, especially New Zealand and Queensland, and with the exports of certain South American States. But this new quota would not much disturb the contrast, for 1400 tons of beef would cover the receipts from both the last-named regions. Disregarding for the moment this relatively insignificant item, without intending to set it down as an impossible source of future competition, I may roughly show the change in the sources of our beef imports, live and dead, as between Europe and America thus:—

Cattle and Beef Imported.	1877.	1883.	1886.
	Tons.	Tons.	Tons.
From America	40,000	125,000	110,000
From Europe	44,000	62,000	29,000

Why the present sources of our beef supply are thus mainly American, we may perhaps discover by noticing the existing condition of other countries as to their cattle stock. The following table will show how matters stand outside Great Britain, and what changes have been at work in the last two decades. These figures (again in thousands "000" omitted) will give roughly some notion of the relative position:—

CATTLE in the undermentioned COUNTRIES in thousands.

["000" omitted.]

COUNTRY.	Year nearest to 1867.	Year nearest to 1887.	Increase.	Decrease.	No. of Cattle to each 100 Inhabitants. 1867.	No. of Cattle to each 100 Inhabitants. 1887.
Great Britain	4,993	6,441	1,448	..	20	20
Ireland	3,702	4,157	455	..	66	86
United Kingdom, including Islands	8,731	10,641	1,910	..	29	29
Sweden	1,924	2,327	403	..	47	50
Norway	952	1,017	65	..	55	53
Denmark	1,194	1,470	276	..	68	72
Holland	1,271	1,474	203	..	39	35
Belgium	1,242	1,383	141	..	26	24
France	12,733	13,105	372	..	33	34
Germany	15,000	15,786	786	..	35	34
Switzerland	993	1,212	219	..	38	42
Austria	7,422	8,584	1,162	..	36	38
Hungary*	5,279	5,592	313	..	34	36
Spain	2,905	2,353	..	552	18	14
Portugal	523	635	112	..	12	14
Italy	3,709	4,783	1,074	..	14	16
Russia	21,409	23,628	2,219	..	32	29
United States	23,820	48,033	24,213	..	76	77
Canada:—						
Ontario	2,356	2,018	1,154	..	..	..
Manitoba		87		..	..	..
Other Provinces		1,404		..	..	..
Australasia:—						
New South Wales ..	1,772	1,368	..	604	..	..
Victoria	599	1,303	704	..	..	..
South Australia	124	390	266	..	..	..
Western Australia ..	46	88	42	..	..	..
Queensland	940	4,163	3,223	..	..	..
Tasmania	88	139	51	..	..	..
New Zealand	312	853	541	..	..	..
South America:—						
Argentine	..	18,000	..	..	..	..
Uruguay	..	5,952	..	..	..	..

* Including Croatia and Slavonia.

Such a picture of the stocks of a large portion of the world's surface gives an impression of almost general advance every-

where. The spectacle, so striking in the case of sheep, is not here seen, of a large reduction in the Old World, to balance the added numbers of the New. One European and one Australasian country exhibit a decrease—Spain and the colony of New South Wales. Still it must be pointed out that as cattle are, for obvious reasons, much more legitimately perhaps than sheep, measured with population, it is important that the advance in the number of cattle should be found to keep pace with the growth of meat consumers. Apart from the little questioned fact, that more beef is eaten now per head over the whole world, whatever may be the case as regards mutton, and that therefore a somewhat higher ratio of cattle and persons would seem called for to maintain the balance, it is important to enquire what the density of the available cattle stock is now, and what it was twenty years ago.

Viewed simply in relation to people, it would therefore seem that, while we ourselves have maintained the former proportion of cattle to persons, few of our European neighbours have greatly increased it, and some have notably declined in the scale when thus tested. Sweden indeed has added to her stock, even more than she has added to her people, and possesses 50 head of cattle per 100 persons at the later date, contrasted with 47 at the earlier date. Denmark, which I have already noticed as extending her exports, has now 72 cattle against 68 per 100 inhabitants. Switzerland, Italy and Portugal have all more or less improved their position, but in the two last instances that position is a very poor one. Both Austria and Hungary—if I include, as I believe our latest official returns do not, the provinces of Croatia and Slavonia—show likewise two more cattle for each 100 persons than in 1867. Russia has declined by three head of stock per 100 persons. Germany apparently, though here perhaps the earlier figures are open to some doubt, has slightly retrograded in the interval France, in similar circumstances, seems slightly to have improved; but Belgium, Norway, and still more clearly Spain and Holland, have all dropped behind in this particular form of wealth.

It is, however, a fact not to be overlooked, that the entire addition to the live-stock of the Central European countries is by no means in proportion to the greater demand which now exists everywhere for butcher's meat for food. Among ourselves it is assumed that in a score of years we, on the average, have increased our domestic consumption per man by something approaching 10 per cent., or from 100 lb. to well over 109 lb. Some thirty years ago or more a figure of no more

than 75 lb. per head was proposed as sufficient, and while these estimates include of course all forms of butcher's meat, there is no doubt as to the part which beef has played in the augmentation. Calculations in detail of my own render it to my mind probable that for every 47 lb. of beef we ate in this country in 1867 we consume over 53 lb. now. To meet this demand, it clearly would not be enough to have 29 cattle per 100 now, as we had twenty years ago. We ought to have more than 32 to be as well abreast as before of the annual demand. If we assume that on the Continent the growth of beef-eating has progressed as here (and in view of the lower standard from which a start must be made I should be disposed to expect a more rapid increase), then it is clear that the small additions made to the cattle stocks, and the slight rise in certain cases per 100 persons, do not, even allowing for improved weights of animals slaughtered, indicate such abundant reserves of European beef as would furnish larger exports in future.

To take the case of France, all the evidence points to a very considerable advance in her rate of meat consumption. The official estimates of the agricultural enquiries held at different dates, give 23 kilogrammes in 1852, 25 kilogrammes in 1862, $26\frac{1}{2}$ in 1872, and upwards of 28 in 1882, or from $50\frac{1}{2}$ lb. to $61\frac{1}{2}$ lb. per head. This calculation, as M. de Foville has recently showed, gives rather lower results on each occasion than the situation would perhaps warrant. From another set of figures, not strictly official, but coming also from the bureau of the Agricultural Administration, he suggests a rise of from 29 kilogrammes in 1862 to 34 in 1877, or, as we may put it, from 64 lb. per person to 75 lb. This rise is $17\frac{1}{2}$ per cent. in the course of 15 years, a more rapid rate of progress than our own. The French deficit must therefore grow larger, and will require to be filled from outside sources. The mere increase of one or two head of stock per 100 persons, and that only in certain and not in all the countries of the Old World, will certainly not meet the requirements of the day.

Another disturbing factor, which hinders our forming a clear estimate, from the cattle per 100 persons in any given State, of its possible exporting capacity, or of its possible demands in the way of meat imports from its neighbours, lies in the not inconsiderable portion of the live-stock of the Continent kept for work rather than meat. In the latest French enumeration, out of 13,100,000 cattle, 1,446,000 seem maintained for the labour of the plough and cart. In Germany in 1882 the working number was 3,280,000 out of 15,786,000.

The Hungarian cattle are famed for their working powers,

and are largely engaged in work which with ourselves would be done by horses. In his interesting account of that country in this Journal in 1874, Professor Wrightson showed in what demand these oxen were for working purposes, majestic teams being seen—sometimes as many as 23 of four oxen each at work in a single field. On property after property he visited, he was told that there was "no sale of oxen off the estate," as "they could scarcely breed enough to supply themselves with draught animals."

The greater age at which these cattle necessarily come to the butcher largely diminishes the yearly produce available for man, and adds another reason why our consumers need not look for supplies, or our producers dread effective competition from this part of the world, even were all sanitary barriers removed. The circumstances are entirely altered since, in 1849, Mr. Morton (vol. x., p. 377), bade the farmers of the United Kingdom look to the Continent of Europe as their great future source of lean stock.

Nor are the herds of Europe divided only in different proportions from each other into working and meat-producing steers; there is also a very strange diversity in the returns as to the proportion of "cows," so enumerated, to the total herd in the different countries. To some extent this may be due to inclusion or exclusion of heifers, or even of mere calves in the cow class. A few examples of what I mean will furnish not only fresh argument for that much needed reform, the greater comparability of international statistics, but will help us in trying to form an opinion as to the countries where apparently breeding is most actively going on.

Comparing our own stock with those of the Scandinavian group, we find the division standing thus in thousands ("000" omitted) at the latest date.

Countries.	Total number of Cattle.	Of which Cows.	Percentage of Cows.
	(000 omitted.)	(000 omitted.)	%
England*	4,769	1,837	38·5
Wales	720	283	39.3
Scotland	1,157	417	36·0
Ireland	4,184	1,419	33·9
United Kingdom (including islands)..	10,873	3,974	36·5
Sweden	2,327	1,493	64·1
Norway	1,017	742	73·0
Denmark	1,470	899	61·2

* The details for 1887 not being yet published, the figures for Great Britain are those of 1886.

The slight local differences sometimes commented on between the specially cow-keeping and the other districts of the United Kingdom sink into insignificance when contrasted with the large cow stock of Norway, Sweden or Denmark. If we try how far the same features obtain elsewhere in Europe we shall find matters stand thus :—

Countries.	Total number of Cattle.	Of which Cows.	Percentage of Cows.
	(000 omitted.)	(000 omitted.)	%
Holland	1,474	870	59·0
Belgium	1,383	796	57·6
France	13,105	6,414	48·9
Germany	15,786	9,087	57·5
Switzerland	1,212	662	54·6
Austria	8,584	4,139	48·2
Italy	4,783	1,865	39·0

Thus every State, for which the distinction can be shown from the latest returns, already exceeds largely the United Kingdom in the proportion of cows, Italy alone falling nearly as low on the scale. The German Empire, with half as many more cattle than we have, has, it seems, nearly five times as many cows. Since the future possibilities of larger exports depend on the natural process of increasing the annual production by keeping more cows, there is clearly some presumption that no margin for extension here remains. Our experience here would tend to show that the Continental farmer has his maximum breeding stock now. But do not these facts suggest that we could profitably increase our own proportion of cows?

Again, it would be quite worth while to enquire to what extent the ratios of the meat consumption of the several nations vary. It is difficult to find reliable figures. The Commissioner of Agriculture in the United States, in his speech to the Cattle Convention of 1885 at Chicago, after accepting the 109 lb. I have spoken of as representing our own annual consumption of meat here in all its forms, and claiming for his own country (I am disposed to think not unreasonably) as much as 150 lb. per head, asserts that no European country other than Great Britain consumes more than 76 lb. per head of butcher's-meat. To Denmark he allots that figure, refusing to France more than 70 lb., or to Belgium more than 74 lb.; Germany he takes as consuming 66 lb. per head, and Austria 53 lb.; but to Holland, Spain, Portugal and Russia he will only allow an annual ratio 5 lb. or 6 lb. short of the latter figure; while Italy is placed as low as a consumer of 18 lb. of meat only per head per annum.

Other rates, like those before quoted for France, have been of course proposed as possible, but nothing is more difficult to substantiate with any accuracy than a figure of this sort. The extreme variety of individual tastes and opportunities, the large margin between town and country consumption, so evident in countries where the octroi duty enables an estimate of the former to be made, and the too frequent want of identity in the term vaguely entered as meat, all conspire to deter the statistician from much confidence in the matter.* But for the broad purpose of this article I think I may be allowed to take it that by common consent we ourselves eat at least a fourth more than the most meat-eating of the European States, and twice as much as many of those whose herds we have been considering.

These considerations would, it is true, tell rather in favour of there being a surplus of meat for export from the countries where relatively so little is used at home, but I am disposed to set off against this possible surplus the slower rate of feeding cattle that is usual abroad. Very considerably less weight of meat will be annually available from each 1000 living animals on the Continent than is the case here. Although in contrasting one country with another, in respect of the head of cattle per 100 persons, an ox was a unit in either case, however varied the meat he represented might be, I do not think we should greatly err in considering the smaller consumption more than compensated for by the larger number of animals required to yield the 50, 60, or 70 lb. required for each person.

I do not desire to give the impression, which would of course be erroneous, that there is no considerable trade in live animals in Europe other than the imports we ourselves receive. Incidentally in the case of France I have already mentioned that she was twice as large a mutton importer as we were. Although there was a time, before, for sanitary reasons, we shut our ports against her, when some cattle reached us from France, she too, like ourselves, is "on balance" a buyer of cattle reared outside her own territory. Thus in the twenty years during which we have seen our own live cattle imports rise from 178,000 to 475,000, and fall again to 318,000, both France and Belgium have been importing also. Their margin of imports over exports in each year may be traced in the table at the top of p. 490, the figures of which are in thousands ("000" omitted).

The better to follow the current of the cattle trade within Europe, I extract a series of figures from some tables given by Professor Von Neumann Spallart in his recent valuable work

* I omit any quotation of the relatively large consumption of cities like Paris, Berlin, or London, as those cannot possibly represent average rates.

Year or Period.	United Kingdom.	France.		Belgium.	
	Imports.	Imports.	Exports.	Imports.	Exports.
Average of 1867–76	209	183	55	69	32
„ 1877–81	282	230	194	130	45
Year 1882	344	195	63	103	45
„ 1883	473	216	68	126	52
„ 1884	425	177	63	108	57
„ 1885	373	152	58	127	52
„ 1886	318	..	..	..	..

on international trade, working out in each case the balances shown on either side. They will illustrate in the form I have arranged them which were the cattle-importing and which the cattle-exporting countries of the Continent in 1871 and 1884, years sufficiently near the beginning and the end of the period I have had under review to serve my present purpose:—

Import and Export of Cattle in thousands (to one place of decimals).

1871. (000 omitted.)				Countries.	1884. (000 omitted.)			
Balance of Exports.	Balance of Imports.	Total Exports.	Total Imports.		Total Imports.	Total Exports.	Balance of Imports.	Balance of Exports.
..	246·9	1·6	248·5	United Kingdom	425·5	3·1	422·4	..
..	195·5	12·6	208·1	France	176·8	63·5	113·3	..
..	51·5	19·9	71·4	Belgium	107·9	56·7	51·2	..
..	43·7	62·9	106·6	Switzerland ..	127·1	75·1	52·0	..
59·7	..	290 2	230·5	Germany	110·6	235·9	..	125·3
..	31·7	140·9	172·6	Austro-Hungary	61·2	121·1	..	59·9
222·4	..	223·9	1·5	Holland	1·9	132·1	..	130·2
34·5	..	45·1	10·6	Denmark	20·3	117·2	..	96·9
141·1	..	161·2	20·1	Italy	57·4	71·0	..	13·6
14·1	..	14·3	·2	Sweden	3·8	39·1	..	35·3
66·6	..	66·6	..	Russia	..	27·0	..	27·0
27·3	..	27·3	..	Servia	..	24·7	..	24·7
565·7	569·3	..	..	Total.. ..	..	..	638·9	512·9

Of course, as will easily be seen, no such table can be really exhaustive, but taking it for what it is worth it materially strengthens the inference I have drawn as to the changed position of Europe as a whole. At the earlier date the wants of one country are nearly balanced by the surplus in another. The small margin of excess of imports in 1871 may perhaps be set down to Algerian receipts. By 1884 the surplus or exports of the exporting countries fail to meet the needs of their Euro-

pean importing neighbours, and the larger excess of imports must have been supplied from across the Atlantic.

Before, however, leaving this subject of the international trade in meat, I must again recall the fact that with the movement of the live cattle from one country to another, the question is by no means closed. We must include also the dead-meat trade. To do this in detail and with reference to quantities varying in their designation, would only weary the reader. I will ask permission to illustrate the whole movement as far as it can be done, of course very roughly and imperfectly since many are the pitfalls of international statistics, by adapting, with one addition, from Dr. Von Neumann Spallart's work, a table which attempts to give for each country, European and extra-European, the total values:—

VALUE of the TRADE in MEAT between NATIONS, 1884.

In thousands of pounds (000 omitted).

Countries.	Imports.			Exports.		
	Live.	Dead.	Total.	Live.	Dead.	Total.
EUROPEAN STATES:—	£	£	£	£	£	£
Great Britain	10,505	15,026	25,531	187	240	427
Austro-Hungary ..	1,502	41	1,543	3,235	140	3,375
Germany	5,458	403	5,861	6,797	584	7,381
France	6,044	633	6,677	1,275	273	1,548
Belgium	2,693	1,498	4,191	1,108	876	1,984
Switzerland	1,875	65	1,940	877	192	1,069
Denmark	230	88	318	2,679	747	3,426
Italy	570	26	596	1,321	136	1,457
Russia	..	..	..	889	71	960
Holland	133	61	194	1,016	236	1,252
Roumania	16	7	23	285	4	289
Sweden	43	286	329	628	15	643
Servia	28	..	28	902	..	902
Norway	73	150	223	15	..	15
European Total ..	29,170	18,284	47,454	21,214	3,514	24,728
EXTRA EUROPEAN COUNTRIES:—						
United States	255	..	255	2,940	12,961	15,901
Australasia	1,351	..	1,351	1,007	798	1,805
Algeria	..	38	38	1,521	..	1,521
Canada	158	398	556	1,533	200	1,733
Uruguay	..	..	..	131	1,207	1,338
Argentine	60	43	103	381	504	885
Ceylon	87	5	92	1	..	1
Cape Colony	3	36	39	3	4	7
Newfoundland ..	28	78	106	..	..	..
Extra European Total	1,942	598	2,540	7,517	15,674	23,191
Grand Total ..	31,112	18,882	49,994	28,731	19,188	47,919

The figures carry their own lesson. No country has so large a share of the import column as Great Britain. In the matter of exports, none, if we except perhaps Norway, the Cape and Ceylon, makes so poor a show, notwithstanding our sales of a few high-priced breeding animals. The whole exports of Europe are, however, just half what she now wants, and for most of that she looks to the United States.

Another feature of this trade demands a moment's notice. The magnitude of the whole transaction, as well as the varying sources of the supply, is striking. Fifty millions sterling by this estimate represent the value of the imports of living animals and dead meat taken from one another by the various countries of the world, so far as these come within the pale of civilization and possess accessible records of their foreign trade, as some even that would not like to be called uncivilized still hardly do. If the criticism be made that the export values are put at 47,900,000*l.* only, this is doubtless susceptible of the usual explanation that exports are valued when they start, and imports on arrival, with the cost of transit added. This trade sets naturally in greatest volume toward the populous centres of the Old World, 47½ millions of the 50 millions of imports appearing in the European accounts. Half of this, or rather more, although the figure will doubtless surprise some people, is still due to an inter-European trade, and rather less than half comes from the new settlements of America, Australasia, and Africa. So far as regards yearly exports of live stock, Germany is here credited with more than twice the American quota, or a value of 6,800,000*l.* against 2,940,000*l.*, while Austro-Hungary also supplies to countries outside her borders 3,235,000*l.* of her apparent surplus; but in both these countries there was also a large volume of imports. Denmark, one of the least of States, while importing little, exported in 1884, 2,679,000*l.* worth of live-stock, nine-tenths of the value shipped from the United States.

Within Europe there are only three countries which can be spoken of as doing a material trade in the export of live animals. These countries are Germany, Austro-Hungary, and Denmark. The live-stock thence exported represented in 1884 a value of 12¾ millions sterling. All the rest of the European States collectively export to the value of 8½ millions only. The European trade in dead meat, of which we used to hear a good deal in the earlier days of the agitation for the better exclusion of cattle disease, has not attained important dimensions, a value of 3¼ millions appearing to cover the whole. Belgium, Denmark and Germany are the exporting countries. Belgium, indeed, although territorially one of the smallest and most densely peopled, seems a very large exporter, furnishing provisions to the value of 876,000*l.* in 1884, although *per contra* the needs of

her inhabitants result in an importation of dead meat in other forms to the vastly greater extent of 1,498,000*l*. Indeed, after ourselves, the Belgians take a high place in the list of dead-meat importers, although their purchases are but one-tenth as great as those of the United Kingdom. In the extra-European section of the account it is the United States which furnishes two-thirds of the provision for the older world.

I am sure to be asked what has been the effect of all these imports, whether European or American, on our prices here. I might reply simply by expressing my regret that no clear and comprehensive register of meat-prices exists in this country. Those usually quoted from the London markets are open to much criticism and question. Now that we have the question of market facilities generally referred to a Royal Commission, it may not be out of place to express a hope that steps will be taken to secure better and more general statistics of market transactions. But using the data we have, I offer the diagram printed on p. 495 for the study of those curious enough to trace the course of prices. Both higher and lower prices are quoted for each year rather than an assumed mean price, which cannot be an "average" as long as we are ignorant of the relative quantities sold in the higher or lower grades.

It will be noticed that the Cattle Market prices of live-meat are "closer" now than twenty years ago, and the Dead-meat Market prices considerably "wider," the greatest drop being in the lower grades of the latter. This may probably be due to the opening of the Foreign Market in 1872, and the more recent importations of preserved, chilled, and frozen beef. But I show by the shaded columns of this diagram also the relative number of pounds of foreign meat, live or dead, taken by each head of the population in each year, and it is curious to see how far from uniform is the effect of importation, taken by itself, on price. We may have declining importations with a falling price, as in 1884, 1885, and 1886, or rising importations, as in 1878, 1879, 1880, and 1883, with a price, in the higher grades especially, by no means declining in the same proportion, and even occasionally rising as the imports rise. The lesson which such a picture teaches is one we ought not to forget—that important as are our imports of meat, there are other and even larger factors affecting values, in the fluctuations of our home supply and the varying demands of consumers.

To the farmer who has had patience enough to wade through the figures offered in this paper, one very important question still remains to be answered. Assuming that no overwhelming supplies of beef from Australasia or the River Plate need yet be looked for, and that any increasing European competition

may be rejected as improbable, will America, so much the largest of all existing sources of supply, go on for ever increasing her exports and for ever lowering values here?

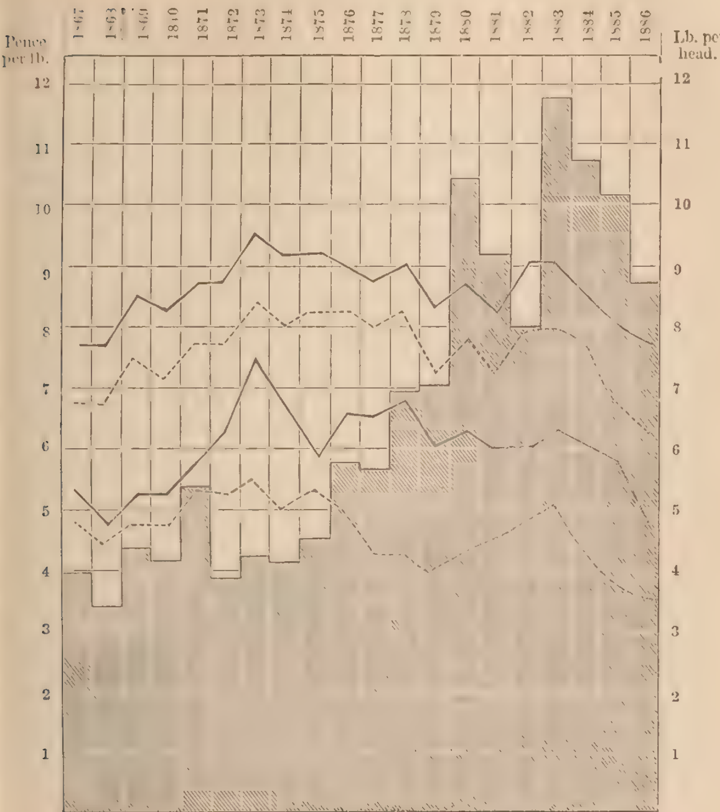
I know the question is usually answered off-hand, by pointing to the large stocks and almost limitless areas of Transatlantic countries, and comparing them with our own. But the student of meat imports will scarcely have learned what the figures really teach if he imagines that the future can be thus easily predicted. It is not always from the largest stocks that the heaviest competition comes. It is a complicated series of factors which determine the increase or the decrease of a trade. The local circumstances of population and consumption, the financial and transport facilities, all largely influence the final result. Nor must we forget, that the world is not wholly engaged in moving meat to man, but that in no inconsiderable degree men are being moved to where the meat abounds. This counter-current must be reckoned with. Increasing emigration, or even its continuance at present rates, may alter the aspect of the meat-supply question in future.

I must not therefore omit some reference to what is happening in America, in the changing relations of surpluses to wants. Of four pounds out of every five of the beef alive and dead which now comes here, the country of origin lies across the Atlantic. Yet the citizens of the United States themselves are not unconscious of the fact that their attention must ere long be directed quite as much to what they can produce for their own use at home, as to what they can send us.

The recent course of the live imports from our Canadian fellow-subjects has tended to separate their case from that of the United States. Their trade, despite the low prices of the day, steadily if slowly grows, while the imports from the States fall. An average of 66,000 head of cattle is now shipped annually from the St. Lawrence, and Canada is thus contending with Denmark for the second place in the roll of our cattle importers. She no doubt owes something to the free entry to our markets which she, like Denmark, enjoys—the result and the reward of the wise jealousy of both these Governments over the health of their native stock. Still, I would not say that, thanks to her own meat-making capacity, we may not yet hear more of Canada materially increasing her supplies. Her grassy ranches in the North-West have yet got elbow-room, and while the extent of her exporting ability is a factor as yet undetermined, I would not consider that we must necessarily make for her precisely the forecast which may be made for the United States.

If in any countries it is important to compare the relative

PRICES AND IMPORTS OF BEEF.



EXPLANATION OF ABOVE DIAGRAM.

The object of this Diagram, as described on page 493, is to show the relation of our current prices to the imports of each year. The black lines running across the Diagram show the limits of the yearly average prices of live meat per lb. (sinking the offal) at the Metropolitan Cattle Market. The dotted lines give the yearly average prices per lb. of the dead meat in the London Central Meat Market as quoted in the Registrar-General's Returns. The figures in the left-hand column represent prices in pence per lb. The figures in the right-hand column relate to the shaded portions of each column, and give the number of pounds of beef, live and dead, imported per head of the population. Thus the first quotation, that for 1867, may be read from the "Cattle Market" prices as ranging from $5\frac{1}{4}d.$ to $7\frac{3}{4}d.$ per lb.; the highest quotation from this market, or $7\frac{1}{2}d.$ to $9\frac{1}{2}d.$ per lb., being reached in 1873, and the lowest in 1886, or $4\frac{3}{4}d.$ to $7\frac{3}{4}d.$ per lb., prices having practically returned to their level of twenty years ago. The "Dead Meat" prices ranged from $4\frac{3}{4}d.$ to $6\frac{3}{4}d.$ per lb. in 1867 up to $5\frac{1}{2}d.$ to $8\frac{1}{2}d.$ in 1873. They have fallen rapidly since 1883. The shaded, or import, columns show that 4 lb. per head was imported in 1867, that this rose to $10\frac{1}{2}$ lb. in 1880, and to $11\frac{3}{4}$ lb. per head in 1883, falling since then to $8\frac{3}{4}$ lb. per head. Prices as well as imports in the last three years have in all grades continually fallen.

growth of population and of cattle, it is doubly so in the case of the United States. There, side by side with an enormous augmentation of cattle, we have a phenomenon quite as remarkable, and one which puts a somewhat different light on the position, in the equally rapid growth of the population.

The people of the United States, who scarcely exceeded 5,000,000 when this century opened, must now number little short of 60,000,000. The successive census returns illustrating this growth up to 1880 show us that the population of the United States doubles itself every twenty-five years. The figures I have already given make it plain that it is not these residents on their own territory who are now the sole claimants on the produce of the soil of the United States. No inconsiderable group of meat-consumers in our own country, in Belgium, in Holland, in France, and perhaps even in Germany, partake of the produce of American cattle, although some of the latter countries have lately closed their ports to the American pig.

Now it has been pointed out, not only by economists on this side of the Atlantic, but by the responsible officials of the American Government, that the stock of cattle in the States has not gained upon the local population. The figures in the table on p. 484 leave the proportion at the present time at just the same figure as twenty years ago, or 77 to each 100 persons. Indeed the United States cattle stock per 100 persons which was 76·6 in 1850, and which rose to 81·4 in 1860, nevertheless sank again in 1880 to 71·6, and was estimated in 1885—even after a vast amount of British capital had stimulated the extension of the ranching industry—at no more than 77·2, or practically the figure which I have used in my table as representing the state of matters to-day.

Speaking at Chicago in the presence of a goodly array of "cattle kings," and addressing some of the shrewdest and most practical of the men who have made American ranching what it is, the United States Commissioner of Agriculture (Mr. Colman) two years ago pointed out, without challenge from his audience, what this state of matters meant, and said—

"In other words, although our cattle have increased in an almost fabulous manner, our population has increased with equal rapidity. It is however only this new region that has so recently been developed west of the Mississippi that has enabled the increase of our cattle to keep pace with the population. In the older settled States the agricultural class has not held its own in its relation to the other classes of our population; farms have been divided and subdivided, and cattle raising, and particularly beef-production, has given way to grain raising and to fruit and truck farming. The effect of this upon the cattle industry is very remarkable. In 1850 we had in the States east of the Mississippi 722 cattle to the thousand inhabitants; in 1880 we had but 521 to the thousand. And if we take the oldest settled States, like New York

and Connecticut, we can see still more plainly what we are coming to in the near future. In 1850 New York had 606 cattle to the thousand inhabitants; in 1880 she had but 460. In 1850 Connecticut had 575 cattle to the thousand inhabitants; in 1880 she had but 380."

These altered proportions, which now obtain between the cattle and the men of so large a section of the United States, and the growth of urban communities with considerable populations in the West, are yet more notable to-day than when these words were spoken, and lend point to Mr. Colman's reference to the fact, on which he emphatically insists, that the Eastern States, as a whole, are rapidly approaching the conditions which hold good in the older European countries. That means, as a necessary corollary, a growing dependence on the beef of the Western States and a growing tendency to absorb the native surplus. Apparently in twenty-one years the proportion of cattle to population, in such a State as New York, will be as low as that in Germany. Indeed, considering the Commissioner's own estimate that the consumption per head so largely exceeds the European standard, New York has already a relatively smaller beef supply than Germany, and in twelve years she is likely to have no greater one than England.

It is important for us here to realise, what the American himself is seeing, that time is running with us in this question. Unless some new and unlooked-for check or change in the rate of American development soon occurs—and we have as yet no sign of this in the tide of emigration which is daily crossing the Atlantic— the meat of the United States will all be wanted at home. As Mr. Colman in the same address which I have already quoted puts it:

In 1880 we had 50,000,000 of inhabitants; in 1905 we should have 100,000,000; in 1930, 200,000,000; in 1955, 400,000,000; in 1980, less than 100 years hence, 800,000,000 of inhabitants. Where are these teeming millions to live? On what are they to subsist? Where and how are the cattle to be bred and reared that must be relied upon to furnish beef? To keep up our present beef supply we must increase our stock of cattle to 70,000,000 within 20 years, and to 140,000,000 within 45 years. Is it possible for us to accomplish this under the most favourable conditions? In the States east of the Mississippi in 1850 we had 15,300,000 cattle; in the 30 years from 1850 to 1880 the cattle in these States increased only 5,000,000 head, or $33\frac{1}{3}$ per cent. Taking the country as we find it to-day, is there any reason to suppose that the percentage of increase will be any greater in the next thirty years than it has been in these States during the last thirty?

Looking at the newest figures we have available, it would seem that the feature just referred to is even more marked in 1887 than in 1885. Out of the 48,000,000 cattle of the United States in the present year, 27,000,000 at least must now be sought for

beyond the Mississippi. While there has been, according to the yearly estimates of the Department of Agriculture, a growth of 12 millions in the herds of the United States in the seven years since the census enumeration, at least $11\frac{1}{2}$ of these new millions are to be found in the West.

But the tales that have been reaching us from the Western ranges this summer have not by any means rung with the old boasts and congratulations and prophecies of ever-advancing production—so familiar in the earlier days. The ranchers one and all have to tell of heavy losses and the havoc of a severe winter. These are not mere newspaper reports to which it is always difficult, even when they correctly report individual losses, to attach their exact representative value. Within the last few weeks the able Statistician of the Department of Agriculture at Washington, Mr. J. R. Dodge, amply confirms the prevalent reports. In writing to me under date August last, he says that the record of the winter reveals "unusual destruction of ranch cattle." In reference to the problem that puzzles us here—the low values apparently current in the face of these losses, he adds: "Though prices are yet low, a relative scarcity will assert itself, and prices will undoubtedly be higher. The ranges are overstocked. The cattle that escaped destruction were weakened, and where the grasses have partially failed cattle are in poor condition. Ranchmen are discouraged, and some are giving up the business."

He acknowledges, of course, that the tide will turn as soon as prices do advance, but he gives it as his own opinion that the free scramble for the monopoly of these pastures, which we here usually call ranching, has had its day, and the whole tendency of the future will be to modification in the direction of smaller holdings and better care for the live-stock.

Recurring once more to the speech of the United States Commissioner for Agriculture in 1885, we find him humorously tracing even then, the travels and troubles of an Eastern capitalist pushing hundreds of miles from a railroad in anxiety to find any "unoccupied portion of Uncle Sam's domain" whereon to found a new cattle-breeding enterprise, and yet at the moment when he hopes he has at last reached a section supplied with water, whereon the white man's foot has never trod, he stumbles upon a cattle ranch.

Two years ago, then, Mr. Colman hinted that the available country was already occupied, that different companies were crowding each other, and that "there was no room for a new comer." And the experience of 1886 and 1887 has not belied his forecast, for we read of numerous instances in which cattle have been driven northward from the overstocked ranches of

Montana on to the newer grassy slopes of the foot-hills of the Rockies in the Canadian province of Alberta.

It is small wonder, then, that men have begun to question the claims of extreme expansiveness which have been put forward on behalf of the wide prairies of the West. The buffalo is gone, and the ox has taken his place; but where the migratory buffalo was wont only to find a sustenance from the grass of the plains at certain seasons of the year, the ox is expected to find it, and to get fat on it, all the year round. If, therefore, these be signs that the business is already overdone, where indeed are we to look for the 70,000,000 cattle the Americans will want by the close of this century, or the 140,000,000 they will need by 1930?

That some very considerable check has occurred, and that in some of the most rapidly advancing cattle districts of Wyoming or Montana, it seems impossible to doubt. I am tempted, without laying too much stress on isolated instances or particular districts, to quote the current stories of ranches claiming last year 1800 head of cattle, and branding this summer only 36 calves. Speaking more generally of Central and Northern Wyoming, the "calf-crop" of 1887 has been asserted to be but one-fifth of that of 1886, and the losses of the winter in cows and in "pilgrim" stock driven into the country from south and east excessive.

I might of course multiply such statements to any extent, but my object will be served if I can establish the fact that enough has happened to make us see that we shall err if we look for a long and certain continuance of ever-developing herds on the prairies of the West, and ever-extending competition either in cattle or in cattle products from the United States.

It is difficult for us here to realise how rapidly the settlement of even the vast area of the great republic is going on. In his Presidential Address to the Royal Statistical Society in 1882, Mr. Giffen argued from the records of population increases in the States, that an addition of 25 millions to the rural population would suffice to occupy all the available area in the same way that the oldest and most settled States of the Union are now occupied. By the year 1900, distant only thirteen years from the time where we stand, as near to us, if I may put it that way, as 1874, he calculates that Kentucky, Tennessee, Ohio, Indiana, Illinois, Michigan, Missouri, Arkansas, Louisiana, Mississippi, Alabama, and Florida, will be filled up with a population as dense as that of the original States. In ten years more we may see the Western States and territories levelled up by the addition of enough inhabitants "to fill the vacuum."

However this may be, there is little doubt that, having

regard to the far higher rate of American meat consumption and to the condition of the Eastern States now, it will require nothing like as dense a population as Europe supports to effectually fill the country, so far as its normal and natural means of production are concerned. Hardly then need we consider whether or no the America of the future is to guarantee us in perpetuity that 800,000 tons of meat, at which some of her prominent citizens have been good enough to estimate our permanent European deficit.

Nor can I think that a consideration of the simple figures of the situation now, which is all I can pretend to offer, gives us any reason to modify the opinion which Mr. John Clay expressed in his Report to the Duke of Richmond's Commission on Agricultural Depression, that in the long run the British farmer need hardly fear, in the matter of meat supply, American competition. We should do well, when we note the landing in the Mersey of shiploads of American cattle, or ponder the relatively heavy arrivals of American beef, to remember that it was pointed out in that Report that "on the very best grazing lands of America it will take more than two acres to do the work of one at home, while out on the prairie on the arid plains of Colorado and Wyoming it will often require the grass product of 50 to 100 acres to keep an animal, while in good wild land it is estimated that a steer will need 10 to 15 acres to carry it through the year." If this be so, and those acres are by common consent allowed to be becoming too narrow for the herds that now graze them, surely the next change in the sources of foreign meat competition will be the gradual elimination of America, just as we have seen the gradual elimination of Europe from the category of dangerous competitors with the grower of English beef.

XXIII.—*Report of the Senior Steward of Live Stock at Newcastle.* By the Earl of Coventry, Croome Court, Worcester.

The forty-eighth annual show of the Royal Agricultural Society of England was held in July 1887, at Newcastle-on-Tyne. History repeats itself, for upon two previous occasions, namely in 1846 and in 1864, the Society had visited Newcastle. A sufficient length of time has elapsed between the meetings to enable us to mark the changes which have taken place in these gatherings; and it will be interesting to all of us, and especially to those who may have been present at the

former meetings, to draw comparisons, and to note the undoubted progress that has taken place in agriculture, as well as the good influence of the Society in promoting the objects for which it was founded in 1838. The subjoined comparative table may be read with interest:—

Newcastle-on-Tyne.	Number of Members.	General Attendance at Show.	Amount given in Prizes.	Number of Implements Exhibited.	Number of Entries of Stock.
			£		
1846	6971	No record.	1391	735	637
1864	5496	114,683	3195*	4024	1099
1887	8982	126,133	6760†	3616	1825

At the meeting of 1846, only 735 implements were shown, as against 3616 in 1887, and it is noteworthy that but one steam-engine was exhibited as against 111 in 1887.

The proceedings commenced on Sunday, July 10th, with the usual special service, conducted in the Showyard by the Reverend Mr. Lister, vicar of St. Andrews, and by the Bishop of Newcastle, who preached an excellent sermon, listened to with deep attention by a congregation largely composed of herdsmen, shepherds, and labourers.

The site of the Showyard was well selected. It occupied a high position on the Town Moor, the use of which had been conceded by the Freemen of Newcastle, whose generous co-operation was acknowledged by a special vote of thanks, proposed by Lord Ravensworth, at the General Meeting of the Society. The well-arranged yard, which gave great satisfaction, afforded ample space for the parade of cattle, and facilities for a trial of the speed and manners of horses in action. It was at Newcastle in 1864—to quote from the able report of Mr. J. Dent Dent at the time—that hunters were first saddled and ridden in the horse-rings; and the writer goes on to remark that this was a novelty. Nowadays judges are accustomed to look upon action and manners as indispensable in a hunter, and these qualifications could be amply tested in the spacious arena in the centre of the yard, which was surrounded by spectators.

At 9 A.M. on Monday, Mr. Jacob Wilson dismissed the Judges and Stewards to their various duties; the yard was thrown open to the public; and the business of selecting the best animals in the respective classes, and awarding the prizes, commenced in

* Including 550*l.* for implements.

† Including 370*l.* for implements, 294*l.* for poultry, and 246*l.* for cheese, butter, and Horseshoeing Competition.

earnest. Other reports will deal more closely with details; and in this brief notice of the stock it will be well to begin with horses. These were regarded with unusual attention this year: partly because Northumberland has always been a horse-breeding and a horse-loving country, and partly because an additional attraction was found in the programme, which included a daily parade of the "Premium" horses "Gumbo," "Knight Templar," "Storm Signal," "Moss Hawk," and "Prescription." These horses had been awarded five equal prizes of 200*l.* each at the Spring Show held at Newcastle, given on the condition that their services should be available in the district at a low fee. The inauguration of the scheme which had been recommended by a committee, appointed by the Council and presided over by the Duke of Richmond and Gordon, was a marked success; for not only were a great many useful horses exhibited, but the large and enthusiastic crowd which was assembled to witness the judging, bore ample testimony to the interest which was felt in a movement calculated to give such a lasting impetus to the breeding of horses in the district.

The results of the experiment were carefully watched, for the question of our horse supply has taken a large hold upon the public mind. It was gratifying to find that the Society had accepted the responsibility cast upon them, of suggesting a scheme having for its object the revival of the practice of breeding useful horses, which had been well-nigh abandoned in many parts of England. In time of war it is absolutely necessary that the means of rapid communication should be at least as effective and trustworthy as formerly; and it will be a serious blow, alike for the service and the country, if we cannot depend upon our home supply to afford the requisite material for cavalry remounts in time of need. This, no doubt, is a material question of the first importance, and the exigencies of the situation are recognized by our Government, who are giving substantial assistance to the movement by grants of money in this country and in Ireland. There would appear to be no opposition in the racing world to the decision to apply the money now added to Queen's plates in the direction of promoting the breed of useful horses. It is felt that Queen's plates have accomplished the purposes for which they were given, and that they now merely remain as superfluous additions to the overwhelming attractions set forth in the programmes of our large race meetings.

But there is also another side to the question, which has been fully examined and which has had due weight with the Society. It must be considered whether the breeding of useful horses, under a proper system of management, is or is not a

profitable adjunct to the operations of the farm. Formerly the rearing of a colt or two was a practice carried on upon most holdings, and it was only discontinued when the difficulties in the way of meeting with a sound thoroughbred stallion, whose service could be obtained at a reasonable fee, became insuperable. The foreigners for years past have bought up the class of sire to which we allude, and the animals which could not pass the veterinary examination have been left behind.

The annual distribution of the grants of money, to which reference has been made, will keep many good sires in the country, and at the same time place their services within the reach of the tenant farmer. If bad horses were never so cheap, it is an acknowledged fact that good ones were never so expensive as at the present time. Corn-growing is an unprofitable operation; land is going out of cultivation; breeding cattle and feeding cattle are equally a drug in the market; but horses, no doubt, can be reared to advantage under a proper system of management, if the necessary encouragement be only forthcoming.

To revert to the parade of the 'premium' horses, it will be only necessary to state that they were all looking well, and apparently none the worse for their season, with the exception of "Moss Hawk," which appeared somewhat light and tucked up. Where all were admired it would, perhaps, be invidious to criticize the merits of each animal, but if there was a special favourite with the critics it might have been "Knight Templar," whose splendid quality and style, combined with substance, action, and good colour, stamp him as a true type of a hunting sire.

Following these came the Shire Stallions, headed by "Harold" (3703), a splendid specimen of the breed. The Clydesdales were a good lot, and "Macaulay" (5187) again established his claim to be considered one of the best horses of the day. Lord Londonderry showed a very useful horse in "Castlereagh," which was not qualified to compete in the Shire, Clydesdale, or Suffolk Classes.

"Truefit," the winner of the first prize for Thoroughbred Stallions, was much admired, and this horse cannot fail, if appearances go for anything, to make a first-class sire.

In the Weight-carrying Class, "Tiptop" and Ring Row," and in the lighter weight, "Orange," "Shamrock," and "Pioneer," were all creditable specimens. The classes for younger animals were well filled, and included a promising yearling colt, "Jubilee," by the good-looking "Mr. Winkle."

It is gratifying to know that prizes for young animals now find a place in the programmes of most of our leading societies. Unquestionably they do much to encourage the breeding of

hunters, and to remove a cause of complaint which has long existed. The raising of cart-horses is popular, because a cart colt is a marketable commodity at six months old. But there is no regular demand for hunting colts until they are four years old; and any circumstance which will conduce to draw them from their places of concealment for purposes of exhibition must lead to dealing transactions, and tend to establish the much-desired trade, at an early age, for this particular class of animal.

The entries in each class of Stock were exceptionally good They were as follows:—

	Newcastle, 1887.	Norwich, 1886.	Preston, 1885.	Shrewsbury, 1884.	York, 1883.	Reading, 1882.	Derby, 1881.	Carlisle, 1880.
Horses ..	500	493	438	407	611	239	256	487
Cattle ..	626	681	539	579	462	598	392	434
Sheep ..	513	446	433	490	412	442	414	434
Pigs ..	194	203	203	211	200	188	167	146
Total ..	1833	1823	1613	1687	1685	1467	1229	1501

Amongst the cattle, the Shorthorns, Herefords, Aberdeen Angus, and Galloways were much admired; but as the Judges' Reports are printed in the following pages, it will be unnecessary to enter into particulars here. The Sheep were a strong Class, and the Shropshires were particularly good. Mr. Joseph Beach showed some very smart shearling rams.

The attendance in the Showyard was, on the whole, satisfactory, and on Thursday the large number of 77,869 people paid for admission. It will be seen by the subjoined table that the attendance was nearly 11,000 in excess of the average of the past nine years:—

1853.—Gloucester	36,245	1871.—Wolverhampton ..	108,213
1854.—Lincoln	37,635	1872.—Cardiff	87,047
1855.—Carlisle	37,533	1873.—Hull	104,722
1856.—Chelmsford	32,982	1874.—Bedford	71,989
1857.—Salisbury	37,342	1875.—Taunton	47,768
1858.—Chester	62,539	1876.—Birmingham	163,413
1859.—Warwick	55,577	1877.—Liverpool	138,354
1860.—Canterbury	42,304	1878.—Bristol	122,042
1861.—Leeds	145,738	1879.—London	187,323
1862.—Battersea	124,328	1880.—Carlisle	92,011
1863.—Worcester	75,087	1881.—Derby	127,996
1864.—Newcastle	114,683	1882.—Reading	82,943
1865.—Plymouth	88,036	1883.—York	128,117
1866.—No Show this year	..	1884.—Shrewsbury	94,126
1867.—Bury St. Edmunds	61,837	1885.—Preston	94,192
1868.—Leicester	97,138	1886.—Norwich	104,909
1869.—Manchester	189,102	1887.—Newcastle	127,372
1870.—Oxford	75,749		

The following table, showing the number of persons paying for admission (holders of season tickets, exhibitors and others not being included), may be read with interest:—

Place of Show.	11 A.M.	1 P.M.	3 P.M.	5 P.M.	Total for the day.
FIRST DAY.—ADMISSION 5s. EACH.					
1880.—Carlisle	1,352	2,013	2,418	2,451	2,455
1881.—Derby	1,079	2,334	3,090	3,248	3,256
1882.—Reading	406	1,180	1,599	1,709	1,717
1883.—York	1,231	2,370	2,875	3,008	3,012
1884.—Shrewsbury	781	1,691	2,104	2,179	2,183
1885.—Preston	1,299	2,804	3,310	3,554	3,557
1886.—Norwich	186	515	608	625	625
1887.—Newcastle	475	786	1,037	1,086	1,097
SECOND DAY.—ADMISSION 2s. 6d. EACH.					
1880.—Carlisle	5,612	8,166	9,326	9,456	9,459
1881.—Derby	4,156	8,756	11,203	12,201	12,314
1882.—Reading	1,516	4,297	5,306	5,640	5,662
1883.—York	6,400	12,443	15,164	15,738	15,768
1884.—Shrewsbury	3,881	9,374	11,113	11,193	11,211
1885.—Preston	7,198	14,356	20,456	21,583	21,713
1886.—Norwich	2,482	6,606	7,792	8,057	8,074
1887.—Newcastle	4,260	8,454	10,525	11,145	11,331
THIRD DAY.—ADMISSION 2s. 6d. EACH.					
1880.—Carlisle	7,740	11,433	12,830	13,156	13,164
1881.—Derby	9,251	8,963	16,534	17,967	18,130
1882.—Reading	2,544	9,072	12,776	13,403	13,461
1883.—York	5,662	15,717	20,941	21,770	21,820
1884.—Shrewsbury	4,441	11,331	13,191	13,554	13,474
1885.—Preston	5,404	14,164	17,672	19,218	19,318
1886.—Norwich	2,829	7,336	9,875	10,878	10,894
1887.—Newcastle	3,298	8,287	11,138	11,931	12,020
FOURTH DAY.—ADMISSION 1s. EACH.					
1880.—Carlisle	16,396	36,247	41,095	44,261	42,682
1881.—Derby	15,034	32,361	42,997	52,196	53,291
1882.—Reading	11,670	30,688	40,000	42,291	42,437
1883.—York	21,052	44,971	60,658	62,986	63,097
1884.—Shrewsbury	15,542	36,995	47,769	49,115	49,374
1885.—Preston	10,813	23,854	30,161	33,503	34,302
1886.—Norwich	19,379	36,652	41,291	42,695	42,774
1887.—Newcastle	28,752	49,037	67,390	76,672	77,410
FIFTH DAY.—ADMISSION 1s. EACH.					
1880.—Carlisle	10,723	18,161	23,166	23,683	23,981
1881.—Derby	11,073	24,125	36,315	40,153	40,639
1882.—Reading	5,125	13,220	17,944	10,395	19,511
1883.—York	8,018	17,484	22,649	24,095	24,120
1884.—Shrewsbury	5,962	13,920	16,978	17,628	17,690
1885.—Preston	3,820	8,538	12,853	14,722	14,908
1886.—Norwich	18,413	32,472	40,036	42,284	42,394
1887.—Newcastle	7,743	16,117	21,530	23,191	24,305

The total amount of money taken at the stand in the Horse-ring was 650*l.*, and 500*l.* was realized by the sale of catalogues.

The Working Dairy was well attended by a large number of visitors, who listened to the lectures and explanations of Miss Smithard with advantage, and watched with intelligent interest the improved process of butter-making.

The seed stands, as usual, presented an attractive appearance, and the old-established firms of Messrs. Webb, Carter, Sutton, Dickson, Little and Ballantyne, &c., were well represented. The Hide Inspection Society of Newcastle had a stand in the yard, where hides, both raw and tanned, which had been depreciated in value by the warble maggot, were to be seen. The essay of Mr. Horn, who won the 20*l.* prize of the Society, was given away at the stand.

The Horse-shoeing Competition attracted considerable attention, in a square set apart in a corner of the large yard. In another part of the Journal will be found the separate Report on this Competition by Mr. Charles Clay, the Steward of the Department, to whose exertions its success was chiefly due.

His Royal Highness the Prince of Wales, and his two sons Prince Albert Victor and Prince George of Wales, who were staying with Sir Matthew and Lady White Ridley at Blagdon Hall, visited the Show on Tuesday and again on Thursday. His Royal Highness has always been a consistent supporter of the Society, having upon three occasions filled the presidential chair; and his presence in the yard was not only a great encouragement in these dark days of depression, but it also assured us of his sympathy and hearty desire to do everything in his power to promote the prosperity of agriculture.

At the general meeting of the Society, presided over by our excellent President, Lord Egerton of Tatton, and held in the large tent on Tuesday, Prince Albert Victor was elected a member of the Society by acclamation. A vote of thanks to the Mayor and Corporation for their cordial reception of the Society was proposed by the Prince of Wales, seconded by the Duke of Northumberland, and carried unanimously, as was also one to the Local Committee. All were glad of the opportunity of acknowledging the zealous co-operation of the Mayor, Sir Benjamin Browne, who had throughout taken a great interest in the arrangements, and was most constant in his attendance at the Council meetings in Hanover Square.

Lord Ravensworth, and many others living in the neighbourhood, entertained parties of friends for the week; and Lord Armstrong, with characteristic hospitality, gave a dinner in the banqueting-hall at Jesmond Dene to the Council, Judges, and other leading officials connected with the Society.

The A division of police were engaged throughout the week, and, as usual, discharged their duties with tact and discretion, and it is a real pleasure to have to record that there was not a single case of disorderly behaviour brought under my notice. The office-bearers of the Society will always retain a grateful recollection of the kindness they received from all with whom they had business relations at Newcastle-on-Tyne. It is a pleasure to serve under Mr. Jacob Wilson, the Honorary Director, to whose energy, close attention to details, and powers of administration, the success of the meeting is largely due. Considerable pressure was put on the railway companies, and their resources were severely taxed, by the large number of visitors pouring into the town, for it was computed that 30,000 passengers arrived by the ordinary and excursion trains on the memorable Thursday. Mr. Reid, the station-master at the Central, was equal to the occasion, and he is entitled to credit for the adroitness with which he handled the large crowds.

In conclusion, I can only say that for my part I shall always look back with gratification upon my term of office; and, in offering my sincere thanks to each and all of my brother stewards for their kind assistance upon every occasion, the regret which I feel in taking leave of them is tempered with pleasure in knowing that I shall still continue to be associated with them in the ordinary business of the Council. I am especially grateful to Messrs. T. H. Miller, M. M. Reynard, and J. G. Fair, since it is to their unremitting assiduity in marshalling the men that any success which may have attended the parades is to be attributed. Nor must I forget to express the cordial thanks of every one connected with the exhibition of Stock to Mr. Henry Wallace, of Trench Hall, who was kind enough to undertake the onerous office of Steward of Forage for the year, and who was always at hand with assistance and advice.

XXIV.—*Report on the Exhibition of Live-Stock at Newcastle.* By JAMES MACDONALD, of Edinburgh.

TAKING all in all, the Newcastle Meeting of 1887 was the best of the dozen Royal Shows which the writer has attended. Never before, excepting at the great Battersea Meeting in 1862, and at the still greater gathering at Kilburn in 1879, has there been at the Royal Show such a completely representative display of British breeds of farm live-stock as at Newcastle this year. In the fullest sense of the term it was a British, and not merely an English Agricultural Show. There is not in the United Kingdom a variety of farm live-stock of importance, not one worthy of the designation of "breed" (if we except, perhaps, the once

noted but now neglected and declining Longhorn) that was not represented on the Newcastle Moor. This in itself imparts a special interest and unusual importance to the Meeting of 1887.

The representative or comprehensive feature of the Show was its most strongly-marked characteristic. In the great collection of live-stock there were no prominently outstanding features, no abnormally extended classes such as those of Red Polled Cattle at Norwich last year, and of Shropshire Sheep at Shrewsbury in 1884. The locality of the Show accounted both for this absence of excessively large classes, and for the exceptionally representative character of the display. In the districts embraced in the "Circuit" visited this year, extensive and important from an agricultural point of view as they are, there are no distinctively "local breeds" of live-stock. True, the ancestral home of the Shorthorn lies within the North-Eastern Circuit; but this, the greatest of all our valuable breeds of cattle, has become so thoroughly cosmopolitan as to be as much at home in one part of the kingdom as another. There were thus no classes that could be said to be distinctly local. Then the proximity of the Show to Scotland brought out a creditable representation of the best which that country can exhibit in horses, cattle, and sheep. The Society prepared a liberal and well-designed Prize List, and the attractions of this were considerably enhanced through the enterprise of the supporters of some of the leading Scotch breeds, who contributed handsomely to the prize-money.

In design and detail the Showyard was similar to former years, with here and there such improvements as experience has suggested. This is not the place to dwell upon the admirable manner in which the Royal Show is conducted; but the writer may be permitted to say in a word that, upon the whole, the arrangements were all that could have been desired, and that the Honorary Director of the Showyard, with his efficient and obliging corps, carried out the proceedings with all the regularity and smoothness characteristic of the "Royal." The responsibility was great, but it sat lightly upon accustomed shoulders.

A word is due to the Railway officials for their excellent arrangements; and also to the daily press of Newcastle, which rendered unparalleled services to the Society in connection with the Show.

HORSES.

The display of horses derived special interest from the presence of the five excellent Thoroughbred Stallions, "Gumbo," "Knight Templar," "Moss Hawk," "Prescription," and "Storm Signal," which won the Society's five 200*l.* premiums at the Show at Newcastle in January last. These valuable

horses were paraded daily after Monday, and it was gratifying to find so much kindly interest manifested alike in the horses themselves, and in the important and well-designed movement which was recalled by their presence. There has been but one opinion expressed as to the prudence of the step which the Society took in offering these premiums to Thoroughbred Sires—all commend it heartily, and hope that the movement may by degrees assume a wider scope. The horses too were well thought of, although it would be going too far to say that there were no critics about.

The Draught Horses formed the chief feature in the equine department. Shires and Clydesdales contended with each other for pre-eminence, and of both there were several excellent specimens. A few good Suffolks also appeared, while in the Classes confined to Agricultural Horses other than Shires Clydesdales or Suffolks, there were two or three animals of surpassing merit. The great variety in our draught horses has often excited surprise and been commented upon. It has been said that since a draught horse is a draught horse all the world over, with similar work to perform, there should be but little variation in the type and method of its build. Wide differences in size are intelligible and desirable, but it is not unreasonable to say that theoretically there should be but little diversity in type, only as much as would correspond with the variety in the work which draught horses have to accomplish.

By degrees the Shire and Clydesdale breeds are approaching each other in form and general attributes. And every movement which tends to facilitate the assimilation of these two valuable races, and to bring them into agreement with one well-defined and recognized type, should have hearty encouragement. Both breeds would be benefited,—the Clydesdale would gain in weight, and the Shire in activity, length of pastern and quality of bone. Evidently opinion is firmly set against a free interchange of blood ; but without desiring to raise that delicate question, we would at least venture to suggest that much advantage would be gained by a free and friendly exchange of idea and purpose amongst breeders of Shires and Clydesdales, as indeed amongst breeders of all kinds of live-stock.

The divergence of type was seen most clearly in the " Agricultural Classes," for there the big, powerful Shire and the smaller but active and clean flat-boned Clydesdale—Shire and Clydesdale in all but pedigree—were brought into close contact. The Clydesdale type was most in favour with the Judges, and so it carried the palm, leaving out in the cold some very noted winners in other important English Showyards.

Theoretically we would say that all horses bred for draught

should be classed, like hunters, according to their size or "weight;" for as to the formation of feet, pastern, leg, shoulder, &c., and as to the form and quality of bone and action, similar if not identical canons of judgment should be applicable to all draught horses. But with our separate breeds, as they now exist, this is out of the question, and the next best thing one can hope for is that, by interchange of ideas, the breeders of the various races will by degrees bring their favourite types nearer to the one grand pattern which constitutes the perfect or ideal draught horse.

Shire Horses.

Those who wish to see the Shire breed in its full strength, must visit the great Show of the Shire Horse Society in London in the spring of the year. That is indeed the largest Show of the kind held in this country, and its success is worthy of mention here. It is in no way antagonistic to the "Royal." Every movement which encourages the improvement and extension of live-stock breeding must in the end contribute to the strength of the "Royal," for successful breeders who would seek distinction will always be anxious to let their best animals be seen in the Royal yard, if only the Society continue to afford them reasonable encouragement to do so.

On this occasion, considering the situation of the Show, there was a very creditable display of Shire Horses. Stallions foaled prior to 1884, of which there were eight entries, made up a moderate class. Mr. A. C. Duncombe, of Calwich Abbey, Ashbourne, won easily with his powerful horse "Harold" (3703), which, crowning many other honours, won the Elsenham 100 Guinea Challenge Cup at the London Shire Horse Show last February. Bred by Mr. J. H. Potter, The Hall Farm, Spondon, Derby, "Harold" is six years old, was got by that well-known sire "Lincolnshire Lad II." (1365), and out of "Flower" by "Champion" (419). "Harold" is a big brown horse, with great muscle, good action, massive, well-formed fore-parts, but scarcely so well made behind. He was a popular Champion in London, and was again rightly enough declared the best Stallion of the breed in the Show. This horse has much improved in form since he first came into public notice. He is of a wearing kind, with much more of the useful than the ornamental about him.

The placing of the other prize-horses caused a good deal of comment; but the Judges were not quite pleased with either of them, and most probably on this account had some little difficulty in quite pleasing themselves, not to speak of the outside public. Mr. A. B. Freeman-Mitford's "Hitchin Conqueror"

(4458), the second winner, stands rather far from the ground, but he is reckoned to have good legs and feet, and also good action. He is only four years of age, and should he fill out, as he promises to do, he will be formidable as an old horse. He was lower in the list in London. Bred by Mr. G. S. Shepperson, Lockington, Derby, he is a son of the celebrated "William the Conqueror" (2343), and out of "Flower," by "Honest Prince" (1058). With many onlookers, Mr. Thomas Shaw's very active and useful six-year-old grey horse, "Agricola" (2700), was a leading favourite. He is a trifle slack in the middle, but is short in the leg, with good bone and splendid movement. He too has been winner at former Shows, was bred by Mr. Valentine Godfrey, Wisbech, and got by "Thumper" (2136), out of "Darling" by "Samson" (1946).

Three-year-old Shire Colts numbered seven, the other entered not being present. Mr. Walter Gilbey's "Real Briton" (4641) led easily. He is comparatively low in stature, being short in the leg; but he is exceptionally thick, with well-formed body and powerful limbs, his fore-arm being wonderful for so young a horse. He has won many leading honours, and was marked as the "reserve" here for the best Stallion of the breed. He was bred by Mr. V. Eastgate, Holbeach, Lincolnshire, and got by "True Briton" (2684), dam "Brisk" by "Matchless" (1542). The Earl of Ellesmere's "Chieftain," which came second, is a promising bay of moderate build, but, like most Derbyshire horses, clean in the bone and a good mover. He was bred by Mr. W. Riley, Boulton, Derby, and got by "Champion" (457). Mr. C. E. Galbraith's "Don Pedro" (5002), which made a close third, is a very good short-legged black colt with good bone, bred by Mr. J. Morton, Wales Hall, Aston, Yorkshire, and got by "Don Carlos" (2416).

Two-year-old Colts made a very good class, 14 entered and 11 present. The leading winners here are exceptionally promising. The Earl of Ellesmere's first-prize colt "Don Juan," bred by his Lordship, got by "Don Carlos" (2416), and out of "Cornflower" by "Lincolnshire Lad II." (1365), is a well-formed bay, with good bone, an excellent mover, and likely to come out well. He wants depth and strength of thigh a little, but may improve there. Mr. Topham's "Causeway Prince" made a very close second. He wants depth of back rib a little, but is a right good stamp of colt, with a good deal of strength and considerable promise of usefulness. He was bred by Mr. T. W. Parnell, The Causeway, Thorney, Peterborough, and got by "Thorney Tom" (3370). Mr. P. A. Muntz, M.P., had a good third in "Derbyshire Hero," a thick black colt with good body, but a trifle round in the bone.

As a class, the Yearling Colts were not so good. Mr. Peter Blundell took the lead with "Premier Fashion," a very big, powerfully built brown, rather short in the hind pasterns, and stiff in movement. He was bred by Mr. Samuel Saint, Dairy House, Alkmonton, Derby, and got by the famous sire, "Premier" (2646), dam by "Tom King" (4752). Some would have preferred Mr. T. H. Miller's second colt "Moloch," an attractive bay of considerable promise, bred by Swarbrick Brothers, Hey Houses, Lytham, Lancashire, and got by "Fen Champion" (3085). Mr. W. Burdett-Coutts, M.P., got the third prize for a good bay colt "The Baron," which, when known as "Leake Jubilee," won the first prize at London Spring Show.

In the class for Mares and Foals there were eleven entries, two animals being absent. It was above the average in merit, although several better Shire mares than any exhibited here have come out in recent years. The Earl of Ellesmere's first-prize mare, "Miss Stonton," has many admirers and not a few detractors. She is not perfect, not in any sense of the term a meritorious animal, yet she is a useful sort of a mare, strongly built, and well put together. The Judges describe her as "a thick heavy mare of quite the right type." The opinion of these gentlemen is entitled to much weight, yet the writer could not go so far as to say that she is perfect in "type." "Miss Stonton" has won many prizes, and was here declared the best among the mares and fillies. She was bred by Mr. G. Chapman, Langham Lodge, Oakham, and got by "Stonton" (2065).

The second-prize mare, "Pride of Colston," owned by Mr. R. M. Knowles, is a very good, low-set, useful seven-year-old black, with promising foal at foot, by the prize horse "Esquire" (2774). This mare was bred by Mr. Clare, Leicester, and got by "Ace of Trumps" (17). Mr. Walter Gilbey's third mare, "Startling," is a thick, strong roan, of a good cart-horse stamp, bred by himself, and got by "Champion" (2410). She had a nice foal at foot, by the double-Champion "Spark" (2497).

There was a good Class of Three-year-old Fillies, yet Mr. W. Bouch's very handsome and promising brown filly, "Wildflower," was a clear enough first. She has won "all round" at the Summer Shows, and looks like growing into a grand mare. She is well formed, stylish, and active; bred by her owner, got by "Reality" (2882), and out of "Hitchin Flower," by "Tom of the Shires" (2682). She was marked as the "reserve" for the best filly, and some good judges would have been inclined to have given her the special prize over "Miss Stonton." Mr. Walter Gilbey had a good second in "Shire Style," a nice-

looking black, of some promise, bred by Mr. John Pearson, Naseby Garstang, and got by "Lincoln" (1350). The third prize went to another good black, the Earl of Ellesmere's "Blackpool," bred by Mr. Peter Blundell, and got by "Bar None" (2388).

The Judges speak highly of the Two-year-old Fillies, amongst which there were several animals of unusual promise. The contest here was very keen, and it is necessary to state that the selection of the Judges did not quite harmonise with the prevailing ideas outside the ring. It will be seen that they express a very favourable opinion of Lord Middleton's "Silver Queen," which was placed first. She is certainly a big, strong filly, well formed in front, but not so good behind, and hardly so stylish as some of the others. She was bred by Mr. J. C. Allen, Hertford, and got by "Thumper" (2136). The Earl of Ellesmere's second filly, by "Don Carlos" (2416), is a very promising black, with a good deal of bone, and of excellent quality. Mr. P. A. Muntz's stylish chestnut filly, "Pride of Dunsmore," by the excellent sire, "Canute" (2736), was left in the third place, but by several good judges she would have been placed higher, if not indeed at the top of the class.

The Class of Yearling Fillies was the weakest in the Section. Of seven entered, only three put in appearance. The Earl of Ellesmere's first-prize filly is a fairly stylish bay, bred by himself, and got by "Briton's Boast" (3004). The second, also owned and bred by his Lordship, is another bay of fair merit, got by "Ambassador" (3428). Mr. P. A. Muntz's "Gem of Dunsmore" is rather high in the leg just now, but is of nice quality, and promises to fill out well.

Report of the Judges of Shire Horses.

CLASS 1—*for Stallions foaled before* 1884—was not a strong class, No. 5 being an easy winner.

CLASS 2.—There were eight entries, one being absent. One very good-looking colt had to be passed over, as he went lame when trotted round the ring. No. 11, a thick compact colt, rather on the small scale, was first.

CLASS 3 furnished some good animals, though there were three absentees, the first and second prize winners being exceedingly promising colts.

CLASS 4 was a moderate class.

CLASS 18—*Mares and Foals*—produced some first-rate animals, the winner being a thick heavy mare of quite the right type.

CLASS 28—*for Three-year-old Fillies*—was a good class.

CLASS 29—*for Two-year-old Fillies*—produced several good animals. The winner, No. 230, a grey, with immense substance, will probably often be heard of in the Show-ring, though she was pressed hard by No. 222, a black filly of very superior quality.

CLASS 30 was a very indifferent class, only three putting in an appearance out of seven entries.

HUGH GORRINGE.
HENRY OVERMAN.
HENRY SMITH.

Clydesdale Horses.

Rarely, perhaps never, excepting at the great Exhibitions at Battersea Park in 1862, and Kilburn in 1879, has there been such a fine display of Clydesdale horses south of the Border as there was at Newcastle. The entries were numerous, and in all the classes there was high merit, those of Two-year-old Colts, Brood-mares, and Fillies, being exceptionally good. The best Clydesdales in the kingdom eligible for these classes were present.

In a good Class of Adult Stallions the first prize went to Mr. Peter Crawford's four-year-old bay, "The Milroy" (4574), bred by Mr. James Milroy, Stranraer, and now taken to America by Messrs. Galbraith Brothers. He was got by "Master Lyon" (2288), and while he lacks style a little, he is a big powerful horse, with grand legs and feet. Mr. David Riddell's second horse, "Duke King," bred by Mr. Charlton, Shaw House, Stocksfield-on-Tyne, got by "Merry Monarch," and out of the famous old mare "Nanny," is a well-made brown of good quality, but not quite faultless in movement. Mr. McCowan's third horse, "Prince of Airds" (4641), winner of first prize at Kilmarnock, and third at Dumfries Highland Show, is a big, strong, short-legged brown, with good feet and action, bred by Mr. Webster, Airds, New Galloway, and got by "Good Hope."

The Class of Three-year-old Stallions was not large, but was of still higher merit. Mr. Andrew Montgomery, who achieved great success here by heading the three Colt Classes, took the lead with his valuable horse "Sirdar" (4714), bred by Mr. Baird of Urie, got by the famous "Darnley" (222), and out of the well-known prize mare "Concetta." "Sirdar" triumphed over all the Clydesdale stallions at the Glasgow and Ayr Shows this year, and was here awarded the Special prize for the best Stallion of the breed. To English breeders he seems too light in the limb; but his bone is clean and of the very best wearing description, and rarely have such grand feet and pasterns been seen. He moves admirably, and is full of promise. Mr. David Riddell had a very good second in "Craigie," a very attractive stamp of a horse, a trifle short in the hind pasterns, but with all the quality, character and promise which characterize the produce of his illustrious sire, the renowned "Darnley" (222). He was bred by Mr. R. F. Campbell, M.P., of Craigie House. Mr. James Little's third-prize horse, "Lord Lothian," by "Top Gallant" (1850), is an exceptionally good dark brown, with good legs, but a trifle full in the hocks.

No fewer than sixteen Two-year-old Colts were entered, and there were few absentees. The Judges had stiff work here,

eight grand colts having been drawn for the final tussle. This was undoubtedly the best class of Two-year-old Clydesdale Colts seen anywhere this year. Mr. Andrew Montgomery came first, as at Edinburgh and Ayr, with "Macaulay," a very handsome bay, with true build, fine character, and excellent feet, pasterns and movement. He was bred by Mr. Mark J. Stewart, M.P., Southwick, Dumfries, and got by Mr. Montgomery's famous stud horse "Macgregor" (1487). Mr. James Crawford's second colt, "The Granite City," is a well-shaped, stylish bay of nice quality and excellent bone, winner of the first prize at Glasgow, and at the Perth Highland Show. He was bred by Mr. Walker, of Coullie, Udny, Aberdeenshire, and got by the noted sire "Lord Erskine" (1744). Mr. Galbraith's third colt, "Lord Ailsa," third at Glasgow and Perth, and also by "Lord Erskine," displays grand quality and character, with the best of feet and legs, but wants filling out a little.

The Class of Yearling Colts was also large and of high merit. Mr. Andrew Montgomery led here with his grand colt "Baron of Cally," which was first at Edinburgh. He is handsome in form and moves admirably; bred by Mr. Hamilton, Boreland, Kirkcudbright, and got by "Lord Marmion." Lords A. and L. Cecil had a very good second in "Cawnpore," a well-formed promising bay, wanting slightly in bone, bred by themselves, out of their prize mare "Cornflower," and got by "Lucknow" (3810). The Marquis of Londonderry got the third prize for an exceedingly promising brown, bred by his noble owner, got by the prize horse "Castlereagh," and out of a "Prince of Wales" mare.

The Class of Clydesdale Mares was not large, but it was nevertheless one of the best in the Show. The unbeaten "Moss Rose," acknowledged to be the best living Clydesdale, headed this Class, and won the Special prize for the best mare or filly of the breed. She is now the property of Mr. Gilmour of Montrave, Fifeshire, who owns a most valuable stud of highly bred Clydesdales. She was bred by Mr. George Ure, Wheatlands, Bonnybridge, Stirlingshire, got by "Dunmore Prince Charlie" (634), and out of the "Time O'Day" mare "Rosebud" (1814). She is built as a draught mare ought to be built, with thick, well-balanced body, deep-sloping shoulder, clean, well-shaped legs, well furnished with muscle, and the bone flat, abundant, and of the best wearing quality, while her pasterns are long and sloping, and feet big and sound.

Messrs. R. and J. Findlay, of Springhill, Baillieston, Lanarkshire, had a very creditable second in their powerful well-made brown mare "Chrystal," which has this year followed "Moss Rose" at several Shows, invariably winning when she was absent.

The Marquis of Londonderry's third mare, "Dora," is a big, strong, useful brown, with good feet and pasterns, but not equal in quality to the two placed before her.

A dozen entries made up a good Class of Three-year-old Fillies. The famous "Laura Lee," unbeaten as a two-year-old, but defeated at Edinburgh this year, came out here in good form, and in the absence of the first and second Edinburgh fillies she led rightly enough, and was marked as "reserve" for best mare or filly. She is handsomely formed, dark brown, with good feet and pasterns, and an admirable mover. She is now owned by Mr. R. Paterson, Robgill Tower, Dumfriesshire, and was bred by Mr. D. A. Hood, Balgreddan, Kirkcudbright; got by "Darnley" (222), and out of the "Farmer" mare "Maggie" (781). The Duke of Portland took the second prize with "Dagmar," a heavy useful bay, with good feet and pasterns, and very broad flat bone. She was bred by Mr. James Drew, Nether Barr, Newton-Stewart, and got by Mr. Andrew Montgomery's celebrated stud horse "Macgregor" (1487). The Earl of Cawdor's third filly, "Dewdrop," is a well-made, good-sized bay of a likable style and good action, but not perfect in fore-pasterns, got by the "Prince of Wales" (673).

The Class of Two-year-old Fillies was still larger, and also of high merit. Mr. Gilmour came to the front with "Montrave Lady," a well-balanced handsome bay, with excellent feet and pasterns, winner of second prizes at Glasgow and Ayr, and fourth at the Perth Highland Show. She was bred by Mr. D. McKinnon, Poteath, West Kilbride, Ayrshire, and got by "Top Gallant" (1850). Mr. James McQueen, of Crofts, had a very good second in "Cherry Blossom," a very promising brown of great substance and excellent action, but scarcely equal to the first in quality. She was bred by Mr. W. P. Gilmour, Balmangan, Kirkcudbright, and got by the famous "Macgregor" (1487). Mr. E. Charlton's third filly, "Black Bess," is an attractive black of beautiful quality and character, with good pasterns, but just a trifle thin in the fore feet. She is own sister to Mr. David Riddell's prize stallion "Duke King," having been bred by Mr. Charlton, and got by "Merry Monarch."

Yearling Fillies were fewer in number, but likewise of a high character. Here, again, Mr. Gilmour took the lead; this time with "Primrose," a very promising bay, which won the second prize at Glasgow. She is own sister to the famous "Laura Lee," and is considered to be better at her age than her celebrated sister was. The produce of "Darnley," as a rule, do not show at their best till they are three or four years old, and if this filly goes on as she promises, she will be a formidable opponent as a mare. Mr. Andrew Montgomery's second-prize

filly, which followed very closely, is a handsome brown of nice character and quality, also likely to grow into an excellent mare. She was bred by Mr. R. D. B. Cuninghame, Hensol, New Galloway, and got by "Macgregor" (1487), and out of the "Gleniffer" mare "Dora" (499). Mr. James McQueen's third-prize filly, "Judy," is a very good brown, of a useful stamp, bred by Mr. James McKean, Barmark, Corsock, Dalbeattie, and also got by "Macgregor" (1487).

Report of Judges of Clydesdale Horses.

Class 5.—First horse only of special merit—No. 48—good quality; a little light of bone in fore-legs, with good feet and pasterns, and a good mover. No. 46, second. Not a good second, a little soft in hind bones. No. 51, third, with more substance, a little stiff in movement, but rather cleaner-boned than the second.

Class 6.—First, and Cup winner, No. 57. Great substance and quality, out of hair a little, but grand feet and pasterns, and a good mover. The rest a fair class. No. 56, second. Good quality, a little light of bone; moves fairly. No. 55, a fair horse, but a little out of his fore-leg.

Class 7.—First, No. 68. A grand stamp of the Clydesdale, good quality, good bone, with good feet. Others a fair class. No. 71, second. A horse of good bone and substance, moves well. No. 76, third. Good bone, wants middle, moves well, close on second. No. 74, reserve. Of good quality, scarcely so good in feet and pasterns.

Class 8.—The class, as a whole, good. No. 84, first. Very good; well-boned and good mover. No. 80, second. Good colt, scarcely so well-boned, but moves well. No. 87, third. A colt with good bone and good feet, but not in bloom. No. 79, reserve. A fair colt.

Class 19.—First, No. 168. A beautiful mare, with splendid feet and pasterns, also Cup winner. No. 171, second. A grand low-legged mare, with good feet and pasterns. No. 176, third. A mare of great substance and good feet and pasterns, but lacks the quality of the second. The others of fair merit.

Class 31.—First, No. 241. A grand filly, with good feet and pasterns, and good mover. No. 242, second. Good feet and pasterns; very broad, flat bone. No. 248, third. Sweet filly; a little defective in fore-pasterns.

Class 32.—First, No. 250. A good filly, with good feet and pasterns. No. 253, second. Great substance, moves well, but lacks the quality of the first. No. 254, third. Sweet filly, with good feet and pasterns.

Class 33.—First, No. 269. Sweet filly, grand quality, good feet and pasterns. No. 267, second. Good filly, not much behind the first. No. 265, third. A fair filly. No. 266, reserve. A little coarse.

James Picken.
John Thompson.
Alexander Burr.

Suffolk Horses.

Newcastle is far from the home of the Suffolk breed, so that an entry of ten Stallions, and eleven Mares and Fillies, must be considered satisfactory. In regard to merit, the representation was creditable, although not so strong as it has been at some former Royal Shows—not equal, of course, to the display at

Norwich last year. Only two three-year-old stallions appeared. Mr. A. J. Smith's excellent horse, "Blazer," came first, as he did at the Suffolk Show. He is an active horse, of good style, but is slightly deficient in bone. Mr. M. Biddell's "Pioneer" was also second at the Suffolk Show this year, and at the Norwich "Royal" last year. He is a thick, short-legged, well-put-together horse, but lacks size a little.

The Class of Two-year-old Colts contained eight entries, and was so good that the Judges say that a better is seldom seen in the home of the breed. Mr. Horace Walton took the lead with "Emperor," a famous prize-winner, bred by himself, and got by "Diadem" (1553), and out of "Empress of Paris" (1033), by "Royal Duke II." (1366). He is exceptionally well-furnished for his age, and, should he maintain his form, he will make a grand old horse. Mr. James Toller's second colt, "Salisbury," had better treatment here than in the Suffolk Show, where he was unaccountably passed over. He is fairly well formed in the body, and has, for a Suffolk, exceptionally good legs and feet—quite the best in the class. Breeders of Suffolk horses must give more attention to feet and legs; for without good "understandings," a big, massive body, however handsome, is of little value in a draught horse. "Salisbury" was bred by Mr. J. Hempson, Shotley, Ipswich, and got by "Statesman" (657). Mr. Samuel Toller got the third prize, as at the Suffolk Show, with "Nonpareil" (1602), a useful kind of a colt, not attractive about the head, and scarcely perfect in the knee.

Only two Suffolk Mares with Foals were entered. The Duke of Hamilton's "Gandy Poll" (1606) repeated former victories. She is a handsomely-built mare, compact and well-balanced, smart in movement, and of nice quality. She was bred by his Grace, and got by that fine sire "Statesman" (657), and out of "Smart" (430), by "Emperor" (279). Mr. A. J. Smith's second-prize mare is "Charsfield Lass" (1558), a well-made, four-year-old, dark chestnut, likely to grow into an excellent mare.

In the Class for Three-year-old Fillies, only three were entered, but they all showed high merit. The Duke of Hamilton had a very good winner in "Snowdrop," a big-bodied, handsome filly, with fairly good well-shaped legs. She was bred by Mr. Samuel Wolton, Butley Abbey, Wickham Market, and got by "Chieftain." Mr. A. J. Smith followed with "Princess of May" (1142), a heavy, well-formed filly, of a useful stamp, bred by himself, and got by "Cupbearer III." (566). The Duke of Hamilton's third filly, "Vixen," is attractive in form, but rather light in the bone.

There were six entries of Two-year-old Fillies. The Class,

as a whole, was creditable, and the first-prize winner is an animal of exceptionally high merit. This is Mr. Samuel Wolton's "Virtue" (1767), a beautifully-formed filly, of fine style and quality, short in the leg, and strong in build. She was bred by Mr. Wolton, and got by that excellent sire "Chieftain" (1354), which was also the sire of Mr. Wolton's second-prize filly, "Smart" (1763)—likewise good-looking, and full of promise. Mr. A. J. Smith had a very good third in "Miss Mag" (1760).

Report of the Judges of Suffolk Horses.

We are sorry to have to report a very short show of Suffolk Horses, but we found some very good specimens of the breed. We attribute the scarcity to the great expense of the conveyance from their native county. We also wish to draw the attention of the Council to the desirability of giving prizes to Four-year-old Stallions.

In Class 9 we found two very useful animals.

Class 10 we consider a very good class; indeed we seldom see a better even at home.

Class 35.—We found one an especially good animal.

William Harvey.
R. H. Wrinch.

Agricultural Horses other than Shires, Clydesdales, and Suffolks.

The Classes for Horses not eligible to compete as Shires, Clydesdales, or Suffolks, usually contain a good deal of variety in type. They did so on this occasion. The Shire and Clydesdale patterns were both represented—and creditably represented too—and the awarding of the prizes was watched with a good deal of interest. The Clydesdale Judges made the awards here also; and, as would therefore be expected, animals approaching to the Clydesdale type got the lion's share of the honours.

There was a small but good Class of Adult Stallions, and it was generally conceded that there were few horses in the Yard equal in merit to the Marquis of Londonderry's Clydesdale horse, "Castlereagh" (91). He is a big, massive, five-year-old bay, with grand top, and good feet and pasterns. He has won numerous prizes, and is also proving himself a useful sire. His descent is excellent. He was bred by his noble owner out of the "Prince of Wales" mare, "Nelly," and got by the celebrated "Darnley" (222). Mr. Shaw's second-prize horse, "The Mikado," is a thick, strongly-built, low-set four-year-old bay, of unknown breeding, quite of a useful carting stamp, but not all that could be desired in quality. The third-prize horse, "Pioneer," shown by the Messrs. Pattison, is a strong, useful bay, a trifle short in his hind pasterns.

In the Class for Mares with Foal at foot, three were entered, but only one put in appearance. This was Mr. Edward Charlton's active and clean-legged eight-year-old bay mare, "Queen of Tyne," got by the Clydesdale stallion, "The Chief" (857), and out of the Shire mare, "Diamond," by "All Glory." She was bred by Mr. Charlton, and has won numerous prizes.

Three-year-old Fillies, of which there were eight entries, made a fairly good class, with nothing in it of surpassing merit. Mr. E. Charlton took the lead with "Lassie," a three-quarter-bred Clydesdale, a trifle leggy, but active, and useful-looking. She was bred by himself, got by "Merry Monarch" (538), and out of "Lady," by "The Chief" (857). The Marquis of Londonderry followed very closely with "Princess Charlotte," a thick, well-made bay, of similar descent, bred by its noble owner, got by "Gallant Scot," and out of "Princess Royal," by "Prince of Wales."

Two-year-old Fillies were fewer in number, but of higher average merit. The Marquis of Londonderry had a clear enough winner here in a truly beautiful bay, "Myra," by "Go Bang," and out of "Merryton Maid," by "Prince of Wales," thus combining English and Scotch blood, the latter predominating. His Lordship got the reserve ticket for "Judith," another very good filly of similar breeding, her sire being "Baron Douglas," and sire of dam, the prize horse "Newstead." Mr. Charlton's second-prize filly, a thick, good, useful chestnut, is likewise of similar breeding, combining with Clydesdale blood a strong dash of the Shire. Lord Egerton of Tatton got the third prize for "Marvel," a promising bay of quite the right stamp, bred by his Lordship, and got by the Shire stallion, "Waring's Wonder" (2688).

In a fairly good Class of Yearling Fillies, animals of similar breeding took the prizes,—largely Scotch foundation with a strong dash of the Shire. The Marquis of Londonderry came first with "Blanche," a good-looking brown got by "Go Bang;" and with "Dinorah," a nice black with good flat bone, got by "Castlereagh," his Lordship took the third position. Mr. E. Charlton had a good second in a promising black, got by "Merry Monarch" (538).

The Class for Draught Mares of any Breed, without Foal, contained a few really first-rate animals. Mr. David Riddell took the lead with the admirably-built Clydesdale mare, "Bonny Jean," for which he paid 200 guineas at the Whitehill sale a few months ago. She is a thick, well-topped four-year-old brown, with grand action, and true Clydesdale character. She has won numerous prizes in Scotland. Mr. W. R. Trotter had a very creditable second in "Gazelle," a big active bay of a

very useful stamp, bred by Mr. James Blyth, Leckie Bank, Auchtermuchty, and half-sister to the famous Clydesdale horse, "Knight of Snowdon" (2212). The Marquis of Londonderry's third mare, "Winnie" (5550), is a thick, short-legged, active Clydesdale bay, bred by Mr. R. Hutchinson, Craigsland, Troon, Ayrshire, and got by "Lucky Getter." Lord Ellesmere's powerful Shire mare, "Farmer," the winner of many prizes, was left out in the cold.

The Geldings made an excellent appearance, the prize animals showing great strength and good form. There was a very interesting Class of Pairs of Draught Horses, Mares or Geldings of any Breed. The first prize went to Lords A. and L. Cecil, for their handsome pair of well-known Clydesdale mares, "Edith Plantagenet" and "Cornflower," which won a similar honour at Edinburgh this year. The former of these two is one of the best four-year-old mares in Scotland, and she has won many prizes in leading Scotch Shows during the past three years. She was bred by Mr. Houston, Whiteleys, Dumbarton, got by "Belted Knight" (1395), and out of the "Topsman" (886), mare "Lily of Whiteleys" (2352). "Cornflower" is a year older, also a first-class mare, and has likewise won numerous prizes. She was bred by Mr. Fredericks, Drumflower, Wigtonshire, and got by "Lord Lyon" (489).

The Marquis of Londonderry took both the other prizes with two pairs of considerable merit.

Report of the Judges of "Agricultural" Horses.

Class 11.—First, No. 107. A good horse, with great substance; good feet and pasterns. No. 106, second. Great substance, but wants the quality of the first. No. 108, fair horse.

Class 21.—First, No. 179. A fair animal.

Class 36.—A fair class.

Class 37.—A good class. First, No. 293, a beautiful filly.

Class 38.—A fair class.

Class 39.—Class good. First, No. 303, a beautiful mare, and good mover. No. 304, a grand mare.

Class 40.—A very good class.

Class 41.—First, No. 319. Mares of grand quality, one of them especially a beautiful mare. We thought this class of sufficient merit to receive a Third prize.

James Picken.
John Thompson.
Alexr. Burr.

Hunting Horses.

If not quite so strong in all the classes as could have been wished, there was upon the whole a creditable display of Hunting horses. Eight Thoroughbred Stallions suitable for

getting Hunters were entered, but they could not be described as a first-rate lot. The two first winners in this class at Norwich last year, "Scot Guard" and "Friar Rush," were not entered on this occasion, but the third and reserve stallions at Norwich, "Huguenot" and "Truefit," came forward and renewed the contest. The latter, now the property of Mr. W. Burdett-Coutts, M.P., of Holly Lodge, Highgate, London, has improved since last year, and was placed first without much hesitation. He is a handsome dark chestnut, admirably suited for getting hunters, and well worthy of the high opinion expressed of him by the Judges. Bred by Mr. Charles Snewing, Holywell Farm, Watford, he was got by "Outfit," now in use in Mr. Chaplin's stud at Blankney, and out of "Eleonora." "Huguenot," the property of the Compton Stud Company, bred by Mr. Constable, by "Lowlander," from "Eurydice," shows well in action, better perhaps than "Truefit," and has good shoulders, but is scarcely so true in form. Mr. Steel's third winner, the well-known American-bred horse, "Blue Grass," is well liked by some hunting men. Mr. Walter Gilbey's admirably-bred aged stallion "Pedometer," which has done good service in his day, and shows many strong points, was placed in the "reserve" position.

A moderate Class of Hunter Mares and Foals, with seven entries, was headed by the two mares which stood in the same positions at Norwich last year, namely Mr. W. B. Bingham's chestnut of unknown pedigree, and Major Thwaites's "Marion." They are both good mares of a very useful type. The former had an excellent foal at foot by "Rattle"; while "Marion's" foal, also a promising youngster, was got by the 200*l.* premium horse, "Knight Templar."

In the Class for Weight-carrying Hunters there were sixteen entries, but half-a-dozen of the animals failed to appear. The muster in the ring was nevertheless creditable, all the prizes going to well-known prize-winning hunters. Mr. R. Chapman's handsome seven-year-old bay gelding, "Tiptop," of unknown pedigree, but credited to "Highthorn," was a satisfactory head to his class, and was afterwards awarded the Special prize for the best Hunter in the Show. Mr. Arthur Byass had a very good second in "Ring Row," a well-made seven-year-old, which has often contended with "Tiptop."

The Class of Light-weight Hunters, with twenty-three entries, was the strongest in the section. It contained an abundance of merit, and not a little fresh material. Here a surprise awaited the onlookers. Those two famous hunters, "Shamrock" and "Pioneer," were both present in good form, but it was clear from the outset that a "fresh blade" had caught the eye of the

Judges. A beautiful six-year-old chestnut gelding, "Orange," owned by Mr. J. H. Stokes, moved so admirably that the Judges could not get past him; and as he had youth on his side, they felt justified in placing him before the two celebrated hunters referred to. "Orange," which was marked as the reserve for the Hunter Championship, was got by the French horse "Ouragan II.," which we understand was used with good results in the Carlisle district. This gelding had not before beat such formidable animals, but he was first in the light weight class at Islington. Mr. John Rutherford's "Shamrock" is the *beau ideal* of a light-weight hunter, and would have again been a popular winner. He was bred by Mr. W. Spaight, Derry Castle, County Clare, and got by "Lord Ronald." Mr. W. C. Bingham's grey gelding, "Pioneer," is a hard-wearing hunter, and made an excellent third. Rarely, indeed, has there been as meritorious a third in any class of hunters.

Four-year-old Geldings made up a fairly good Class, in which there were fourteen entries. Mr. Andrew J. Brown took the lead here with "Le Premier," a well-built, active chestnut, got by "Boreas." Mr. J. M. Mitchelson's handsome bay, "Randolph," was liked quite as well by some onlookers. He was bred by Mr. Welford, Ugthorpe, Whitby, and got by "Bass Rock."

The Four-year-old Mares were fewer in number, and not equal to the geldings in merit. The leading winners, however, were very good. Mr. F. Blenkin's "Princess Beatrice" is a well-formed chestnut of desirable quality, bred by her owner, and got by "Bay President."

A large and very good all-round class of Three-year-old Hunter Geldings, containing nineteen entries, was headed by a very attractive bay, shown and bred by Lord Middleton, sired by "King Harold," from "Beeswing" by "Morocco." Mr. Sowerby's "Spartan" is hardly at all inferior; while the redoubtable Mr. A. J. Brown had a good third in a useful bay, got by "Massinessa."

A small Class of five Three-year-old Fillies was not by any means strong in merit, any more than in numbers. Mr. W. Armstrong's first prize filly "Jubilee Queen" is a fairly well-shaped chestnut of some promise, bred by Mr. George Carr, Silloth, got by "Gladstone," and out of "Bessie," by "Laughing Stock." The third prize was withheld.

Two-year-old Geldings were better and more numerous, a few very promising young horses being amongst them. Eighteen were entered. Mr. E. Barton took the lead with "Pilgrim," an exceptionally promising brown of his own breeding, got by

"Carthusian," and out of "Matilda" by "Voltigeur." Mr. R. J. Mann followed closely with "King Twala," a very good brown.

Eleven Two-year-old Fillies were entered, yet the class was not quite satisfactory in merit. Mr. R. J. Mann had a creditable first in "Happiness," a good-looking chestnut, bred by Mr. G. N. Farwell, Walkerfield, Staindrop, Darlington, and sired by "Castlereagh." Mr. T. Tomlinson's second, "Hilarity," promises almost as well, showing some very good points.

Yearling Geldings and Fillies made up a right good class of eleven entries. Quite a meritorious gelding came to the front here—Mr. C. H. Johnson's "Jubilee," a powerful chestnut of exceptional promise, and formed in most parts as he ought to be. He was bred by Mr. Johnson, and got by "Mr. Winkle." Mr. J. T. Robinson's brown gelding, "Gone Away," was by no means an unworthy second. He, too, is full of promise; was bred by his owner, and got by "Sedan" from "Mrs. Whip" by "Baron Cavendish."

Report of Judges of Thoroughbred Stallions and Hunting Horses.

Class 12.—We considered the winner "Truefit" (a most improved horse) as quite the right sort of animal to get hunters, and that great credit is due to his owner for preventing such a horse leaving the country. Besides the second-prize horse, "Huguenot," there was nothing very remarkable.

Class 22.—Not a strong class. Both first and second prize mares occupied the same positions at the Norwich Show. The winner had a very good foal by "Rattle."

Class 42.—A good class; the prize horses are all well-known in the Show-ring.

Class 43.—A very good class of light-weight horses. The winner is a most beautiful mover, and, having youth on his side, beat those well-known old stagers "Shamrock" and "Pioneer."

Class 44.—A fairly good class of *Four-year-old Geldings.*

Class 45. *Four-year-old Mares.*—Not so good a class.

Class 46.—A very fine class of young horses; we commended the whole of it.

Class 47.—Not at all a good class. We only awarded two prizes, according to the conditions, there being only five entries.

Class 48.—A few nice horses.

Class 49.—Not a strong class by any means.

Class 50.—The winner was a remarkable colt, and wonderfully furnished for his age.

Champion Prize in Classes 42–45 was awarded to "Tiptop," the winner in the Heavy Weight Class of *Hunters.* "Orange," winner in the Light Weight Class, was reserve number.

We cannot conclude our Report without thanking the Steward of our department for the able assistance rendered us.

T. Harvey D. Bayly.
J. Maunsell Richardson.
Nigel Kingscote.

Coaching or Cleveland Horses.

Praiseworthy efforts are being made to revive the breeding of these useful horses. It was therefore fitting for the Royal Agricultural Society to provide classes for them at the Newcastle Show. The entries were numerous: 20 stallions, 3 mares, and 12 two-year-old fillies and geldings—in all 35, but many of the animals were not forward. As a whole, the muster was of fair quality, though not quite so good as could have been wished. Nearly all the winners were of high merit, but there was less of the fine old Cleveland character than we had hoped to see in the classes.

In the Class of Stallions, Mr. W. Burdett-Coutts, M.P., took the lead with his handsome three-year bay horse "Sultan," which won the first prize at the London Show, and which has since won first prize at the Yorkshire Show. He is an attractive, upstanding horse, with good bone, fine quality and excellent action, but lacks substance in body. He was bred by Mr. George Leefe, Fryton, Slingsby, Yorkshire, and got by "Emperor" (387). "Sultan" is entered in the newly-established Cleveland Stud Book, his number being 667. Major Godman had a close second in "Guardsman," a well-formed two-year-old bay of much promise, but as yet not perfect in action. He was bred by Mr. Isaac Scarth, Mount Pleasant, East Rounton, Northallerton, and got by "Prince of Cleveland," late "Blooming Heather" (647). The third prize went to Mr. H. R. W. Hart, for "Wonderful Lord," a grand old horse, now out of bloom.

In the Mare and Foal Class only two mares appeared. Mr. F. W. Horsfall took the first prize with "Bonny" (14), a neat, active, aged bay, a trifle light in bone; bred by Mr. T. Goodrick, Sowerby, Thirsk, and got by "Luck's All" (188), and out of a mare by "Salesman" (271). She had at foot an excellent filly-foal by "Fidius Dius." Mr. John Lett's second mare, "Daisy," is a good, useful, five-year-old bay, bred by himself and got by "The General."

The Class of Two-year-old Fillies and Geldings contained several very promising young animals of desirable quality, if some of them were deficient in Cleveland character. Mr. George Scoby headed the Class with "Hannah," a bay filly of much promise, well topped, of nice quality and good action, but scarcely so well furnished with bone as could be desired. She was bred by himself, and got by "Salesman." Mr. John White's second-prize filly, "Lady Annie," is a strong, well-made bay of a useful stamp, but not then moving so well as could be wished.

Report of the Judges of Coaching or Cleveland Stallions.

Class 13.—The class, on the whole, was not a strong one, with the exception of the prize animals. The first prize, No. 121, is a fine upstanding horse, with plenty of quality, freedom of action, and bone, but lacks depth of body. The second, No. 120, is a useful young horse, but lacks action. The third prize, No. 137, is a grand type of old horse, but has seen better days. The reserve, No. 130, is short of size.

Class 23. *Mares and Foals.*—Only two entries. The first prize is a nice quality of animal, rather short of bone, but a very nice strong filly; foal at foot. The second prize has not the size or quality of the first.

Class 51. *Two-year-old Geldings or Fillies.*—The first prize is a promising young mare, with good action and quality, and very good top, but rather short of bone. The second prize is a big bony filly, but was dead amiss, and could not make a good show. No. 3, a nice brown colt, with good top, but might have better action.

There were two or three other promising young things, but they were short of size, and did not show the Cleveland character.

Christ. W. Wilson.
C. B. E. Wright.

Hackneys and Ponies.

The collection of Hackney horses, taken as a whole, was far from satisfactory. The classes were much smaller than at Norwich, and the competition in several of them was disappointing. There were, to be sure, a number of really good hackneys in the Yard, but, on the other hand, there was a considerable percentage of secondary animals. The character of the display is well indicated by the Report of the Judges.

Six Hackney Stallions, above 15 hands, were entered, but only four appeared. The Judges found a clear enough first in Mr. Thomas Reed's "Buckrose" (1629), a thick, active bay, well furnished with muscle, bred by his owner, and got by "County Member." Mr. Walter Gilbey's active and stylish chestnut horse, "Volunteer" (1217), made a fairly good second. A like number competed in the Class for Hackney Stallions above 14, and not exceeding 15 hands. Mr. John Robinson, of Cleavland House, Hull, took the lead with "Young Lord Derby," a very useful-looking three-year-old dark chestnut, bred by Mr. T. Stephenson, and got by the famous sire, "Lord Derby 2nd." Mr. A. Lewis came second with "Confidential," a fairly good four-year-old bay, which was exhibited unsuccessfully at Norwich last year.

In the Class for Pony Stallions above 12 but not exceeding 14 hands, four were entered; but Mr. Burdett-Coutts's "Tommy" did not put in an appearance. Mr. Christopher W. Wilson was, as usual, invincible here. His beautiful seven-year-old black, "Pomfret Wonder," was not quite so blooming as we have seen him, so that his younger relative, "Little

Wonder 2nd," a finely-shaped brown of grand quality, stepped into the leading position. There were a like number of entries in the Class of Pony Stallions under 12 hands. Here the Marquis of Londonderry, who owns some of the finest ponies in the kingdom, carried away the coveted card with "Auchendennan," a beautiful little black, bred by Mr. J. M. Martin, and got by "Mars." Lords A. and L. Cecil came second with "Tommy," a very attractive aged bay, of unknown breeding.

The Class of Hackney Mares and Foals, with eight entries, was not strong. The first-prize winner, however, Mrs. Mackie's "Lady Watton 2nd" (470), is a capital mare, of excellent form and quality. Mr. A. Fewson, of Hedon, Hull, had a fairly good second in "Lily" (219), a good-looking chestnut of his own breeding, and got by "Lord Derby 2nd." Mr. Henry Moore's useful mare, "Frisk," by "Lord Derby" (417), and out of "Princess" (289), by "Denmark" (177), came third.

Only four Hackney Mares of the smallest size were entered. Lieutenant-Colonel T. H. Parker, of Warwick Hall, Carlisle, came first with "Nelly Bligh," a very good bay, bred by Mr. H. Persse, Glenarde, Galway, and got by "Thomastown." Mr. W. R. Trotter, of South Acomb, Stocksfield-on-Tyne, followed closely with "Lucy," a nice, useful bay of unknown breeding, with good foal by "Young Perfection."

Only four Pony Mares were entered in the two Classes. Lords A. and L. Cecil got the two first prizes for "Podgy," a very good eleven-year-old grey, and "Ballantyne," a nice little black, age and breeding unknown.

In the Class for Weight-carrying Hackney Mares or Geldings there were only three entries—one of these being absent. Mr. John Robinson's "Princess," a very good chestnut, by "Lord Derby 2nd," was rightly enough placed first. Mr. W. R. Trotter got the "reserve" ticket for "Constance," a useful brown, bred by Mr. John Rowell, Manor Farm, Bury, and got by "D'Oyley's Confidence."

There was a better turn-out in the Light-weight Class, which had nine entries, and two or three very good mares. Mr. John Robinson's "Ethel" was properly placed first. She is a small but well-made five-year-old bay, with excellent action, breeder unknown. Mr. John Dunne, of Moorehouse Hall, took the second prize with "Carmarthen," a good, useful red roan.

There was a very good Class, with ten entries, of Pony Mares or Geldings, above 13 and not exceeding 14 hands. The invincible "Magpie" came out as blooming and active as ever, and of course again won the leading prize for Mr. Pope. Mr. R. Jackson, of Wetheral Abbey, Carlisle, got the second prize for "Rowena," a very good brown, bred by Mr. G. Spraggon.

Ponies above 12, and not exceeding 13 hands, were fewer in number, and barely equal in merit to the preceding Class. Mr. A. W. Fox, Grove House, Harrogate, had a good first in "Betty," an active and useful brown of unknown breeding. Mr. W. M. Angus, Fenham Terrace, Newcastle, followed closely with "Whitesocks," a very good eight-year-old black gelding, of unknown breeding.

Five excellent little animals appeared in the Class for Ponies under 12 hands. Mr. R. Clayton, of Wylam Hall, came first, and Mr. F. M. Laing, of Farnley Grange, second, with two beautiful little geldings. All the other ponies received tickets of one kind or another. The Class for lots of four Ponies suitable for Coal-pit purposes, not exceeding 10 hands 2 inches, brought out only two entries. The Marquis of Londonderry won the first prize for a group of interesting little things. The Harton Coal Company also had a very good group, which well merited the second prize.

Report of the Judges of Hackney Classes and Ponies.

After having seen the Hackney Show in London, those at Olympia and Islington, this typical breed is, as a whole, badly represented at Newcastle, and it seems clearly owing to the fact that we are somewhat far from the Hackney districts, though Yorkshire being so near, it seems rather surprising the various classes were not more numerously filled. Many of the entries did not put in an appearance, reducing already very small classes to quite mean dimensions.

If we were to individualise classes, it would have to be stated that some were so indifferent as scarcely to deserve the prizes to be awarded. At the same time, glancing through all the classes, some superior animals might be selected, most notably in the *Mare and Foal* Class, in which appeared "Lady Watton 2nd," a very superior animal, and far in advance of her companions; and in the Class of *Hackneys under* 14 *hands*, where the evergreen "Magpie" occupied her usual position.

In the *Pony Stallion* Class may be noted "Pomfret Wonder," slightly deteriorated from his early spring appearance by summer duties, and thus beaten by his relative "Little Wonder 2nd," an animal of great promise and quality.

It is a pity the interesting Class for *Ponies suitable for Pit purposes* had not been more fully represented, there being only two entries of four ponies each. The latter lot showed much quality, and some of them would be valuable pony sires.

HENRY FESTING.
JNO. M. MARTIN.
WM. PARKER.

CATTLE.

The display of cattle was more uniform than that of horses. Taken as a whole, it was both large and good. Its exceptionally representative character has already been noted. Never before,

perhaps, has the great wealth which the British Isles possess in their numerous highly-improved breeds of cattle been more strikingly illustrated than at Newcastle this year. Often, let it be said candidly, there has been in the Royal Show a grander muster of Shorthorns, and perhaps, also occasionally, a stronger representation of some of the other breeds of cattle; but at no former period in the history of British agriculture has such a high standard of excellence been reached by the general cattle stock of the country as was manifested by the twelve distinct races of cattle exhibited at Newcastle.

Shorthorns, be it remembered, had attained a highly-improved condition before most of the other breeds had received any special attention from the scientific breeder. It is impossible that they could go on continually improving. An occasionally retrograde wave may indeed be inevitable.

It is undeniable, however, that while the Shorthorns may likewise still receive a certain amount of benefit from the Show system, the improvement of the other breeds has been greatly stimulated, encouraged, and guided by the Royal Show, and lesser meetings of a similar kind.

In comparatively recent times, substantial improvement has been effected in the rank and file of all the other leading British breeds of cattle, with the result that the cosmopolitan Shorthorn does not now "stand out" from the others as it did in former times. This levelling-up process has gone on steadily for many years, and it cannot be doubted that it has conferred much benefit upon British agriculture. After all, with live-stock, as with people, it is the greatest good of the greatest number—a high standard of excellence all round in the whole live-stock of the country, rather than the special excellence of certain strains or races—that we should strive to ensure. In the pursuance of this desirable end gratifying progress has been made in recent years. The upward movement directed and stimulated by the Royal and other similar Agricultural Societies is losing little of its force or influence. It is a work of great national importance which is being thus carried on, worthy of the best efforts of the best men in the country. Its success, as well as its importance, was amply demonstrated in the Royal Showyard this year.

Shorthorn Cattle.

Shorthorns have sometimes been better, occasionally not so good. As compared with Norwich last year, there was a gratifying improvement. In contrast with the Carlisle Show in 1880, this year's display would not stand well. In regard to numbers, all the classes, excepting that of Cows, were fairly well filled.

There were no animals of surpassing merit, yet if we except that of Three-year-old Bulls there were in all the classes worthy recipients of the leading honours. The Female classes, as a whole, were superior to those of Bulls. "Whole Class Commended," was the verdict of the Judges regarding the three classes of Heifers.

In the Adult Bull Class seven entries were made. Mr. William Handley's "Royal Ingram" (50,374), Champion at the two preceding Royal Shows, and the hero of a hundred other fights, came out in tolerably good form, and led easily enough. There have no doubt been a few better bulls in England during the past ten or fifteen years, yet, taken all in all, he is well deserving of his position. He is long and fairly wide in the frame, with broad level back, and few animals carry so much lean meat as is disposed upon his level carcass. And he is a valuable sire, as well as a good Show bull. At least three of his sons have been Royal winners, and one, "Ingram's Fame," takes the Champion Prize here, he himself being marked as the "reserve."

"Royal Ingram" was bred by Mr. Handley, got by the famous prize bull, "Sir Arthur Ingram" (32,490), and out of "Harmony" by "Sir Arthur Windsor (35,541). Some were heard to express a preference for "Veteran" (52,288), the second-prize bull, owned by Mr. John Vickers, of Catchburn, Morpeth. Good, however, as that bull undoubtedly is—and in several points he is exceptionally strong—we do not see how he could have been fairly placed first. His head is objectionable, and that is not a trifling fault. In other respects he is slightly lacking in Shorthorn character, yet is built upon a large scale, is very deep, correspondingly broad, very massive, and heavily and evenly fleshed. He is exceptionally thick in the girth, but light in the hind-quarters. He was bred by Mr. C. Craddock, Hartforth, Yorkshire, and got by "Lord Rosebery" (45,152).

Mr. Handley's "Reformer" (53,521), which has a few times been placed before "Royal Ingram," was in his right position here. He is a big, well-formed red, with a little white, fills the eye well, and displays considerable merit, but has become somewhat paunchy, and is not quite so firm in the flesh as could be wished. He was bred in Aberdeenshire by Mr. William Duthie, got by the Burnside bull, "Earl of March" (33,807) (brother to the red bull "Duke of Richmond," which won fame in America as a show and stud bull some ten or twelve years ago), and out of a grand-daughter of the valuable Keavil bull "Heir of Englishman" (34,128), which was used with grand results by Mr. Marr, Uppermill, Aberdeenshire. The Ardfert

Abbey bull "Prince of Halnaby" (53,464), which won for Mr. Williams, of Moor Park, Harrogate, the first prize at Norwich last year, had to be contented with the "reserve" ticket on this occasion. He has not filled out sufficiently well, but shows desirable character and quality.

The Class of Three-year-old Bulls, in which there were eight entries, was disappointing. Mr. James McWilliam's "Royal Victor" (52,068), from the north-east of Scotland, was the only bull in the class whose character was desirable; but he lacks filling out, and is deficient in the hind-quarters, so that at least one of the Judges objected strongly to him. He would have been a popular first. He was bred by the Duke of Northumberland, got by the Warlaby bull "Eastern Emperor (44,763), and out of a sister of his Grace's prize cow at the Preston Royal Show. Mr. John Garne's first-prize bull, "Baronet," is certainly much thicker, and carries a great deal more meat; but he is very rough in the hind-quarters, ungainly in character, and a good deal out of form. Mr. Louis Ponsonby, Tring, got the third prize for "Prince Arthur" (51,869), a straight, lengthy white, somewhat out of form.

Two-year-old Bulls made a much stronger class. There were a dozen entries, and all the prizes went to good animals. Mr. Handley's "Ingram's Fame" (53,026) was a clear first, and was also rightly enough awarded the Special prize for the best Shorthorn bull in the Yard. Got by "Royal Ingram," and out of "Anemone 2nd" by "Sir Arthur Ingram," he thus inherits a double share of the blood of the last-named bull, which was not only a noted prize-winner, but also an excellent stock-getter. "Ingram's Fame," like his sire, is red and white in colour, and is similar to his sire in form; but while he is quite as well furnished with lean meat, very evenly laid on, he is better balanced in the frame, being deep behind, and altogether a right good stamp of a bull. He was sold at a long price to go to South America.

The selection of the other prize bulls gave the Judges a good deal of trouble. "Chief Justice," the property of Mr. John Vickers, is considerably younger than the others, but he is a straight level red of excellent quality and character, and no one grudged him the second place. He was bred by Mr. Vickers, got by Mr. Handley's "Ingram's Chief" (51,423), and out of "Purity," by that big massive white bull, "Duke of Howl John," which won the first prize at the Carlisle Royal in 1880. "Chief Justice" has been sold to Mr. Handley, who passes "Royal Ingram" to Mr. Vickers. Mr. A. L. Duncan, of Knossington Grange, Oakham, got the third prize for "Melton," a thick massive roan, with very good fore-rib,

and attractive character, but not well formed behind. He won third prize at Reading this year, was bred by Mr. E. Pease, of the Crundalls, Bewdley, Worcestershire, and got by "Earl of Aylesby 4th" (46,291). Some onlookers would have preferred the reserve bull "MacBeath," a big massive red with a little white, shown and bred by Mr. James A. Gordon, of Arabella, Ross-shire, got by "Macgregor" (50,001), and out of "Bessie Belle," by the 400-guinea prize bull "Rosario" (35,315), son of the famous "Duke of Aosta," which fought many battles successfully with "Sir Arthur Ingram" and other notable Showyard heroes. "MacBeath" is well formed on a big scale, and carries a great amount of flesh for his age, but is a trifle plain in his head, and otherwise not perfect in character. He was purchased by Mr. Handley, and may probably take a higher place in future English shows. Other three very good bulls received recognition from the Judges, namely, Mr. A. Metcalf-Gibson's "Royal Arthur" (53,570); Mr. R. Thompson's "Master Shapely," and Messrs. Hosken and Son's "Marquis of Bute."

The Class of Yearling Bulls, with twenty-four entries, was not only large, but of high merit. Mr. Handley again had a clear enough winner, and rarely, if ever, have so many bulls of such merit as he exhibited at Newcastle been seen in the possession of one breeder—three first-prize winners of his own breeding, one of these being the Champion bull of the breed, another marked as the "reserve" for the Champion Prize, while the third was followed closely in his class by another bull of Mr. Handley's breeding. Upon this wonderful achievement Mr. Handley is to be congratulated. "Golden Hind," his first-prize yearling, is a very handsome light roan, straight and well balanced in form, and admirably fleshed. He was bred by Mr. Handley, got by the Royal prize bull "Self Esteem 2nd" (48,675), and out of that grand cow, "Princess Flora" (by "Alfred the Great" (36,121)), the dam likewise of "Goldfinder," "Golddigger," and "Golden Measure," all of them first prize national winners. This rare cow is, we believe, a grand milker. Mr. Handley says she has been "constantly in milk for upwards of five years, and when newly calved gives twenty quarts of milk daily." "Golden Hind" was purchased at a long price by Mr. D. McLennan for exportation to South America. We much regret to lose such valuable young sires, for from a bull of such high merit, and from such a grand cow as "Princess Flora," some good stock might be expected. But foreign gold is all powerful.

Mr. Anthony Metcalfe-Gibson's second-prize yearling bull "Royal Dalesman," bred by himself, and got by Mr. Handley's

"Royal Ingram," was the most perfectly formed in the class. He is an exceedingly attractive light roan, of fine character and great promise. The Duke of Northumberland's third bull, "Hopeful," is a very straight, handsome red and white, very good on the crops, and also likely to grow into a fine bull. At present he wants depth a little, but has a very good top line.

Four Cows were entered, but only three came forward. Two of these, Mr. T. H. Hutchinson's "Lady Pamela" and "Glad Tidings," have attained great Showyard fame—first and second respectively at Norwich last year. The former has now for the third time won the Champion Prize for the best Shorthorn cow or heifer. As a heifer, "Lady Pamela" was a marvel. She has never been so likable in character as some other of the many choice animals which Mr. Hutchinson has brought out, or as some other famous Royal winners which we can recall; but for width, depth, massiveness, and symmetry of carcass, she has rarely been equalled. She has now become patchy and ungainly in the hind-quarters, but in front of the hooks she is still matchless. In spite of the high condition in which she has always been kept—with little difficulty, for she has not always been on high feeding—she has begun well in breeding. Her patchy hind-quarters were strongly objected to, of course, by all the Judges; but at least one of them considered this fault so serious that he was extremely reluctant to give her the distinction of Champion. "Lady Pamela" is six years old, was bred by Mr. Hutchinson, and got by "British Knight" (33,220).

"Glad Tidings" is a very handsome seven-year-old roan, a little bare on the loin, but of desirable character and quality. Indeed we heard at least one recognised judge say he would have placed her at the head of the class. She too was bred by Mr. Hutchinson, got by "Master of Arts" (34,816), and has had not a few noted relations. The other cow, the Duke of Portland's "Lady Ottoline," was well worthy of the third prize, if the regulations had permitted the Judges to award it.

A capital Class of Three-year-old Cows or Heifers, in-Milk or in-Calf (thirteen entries), gave the Judges some trouble. Type varied considerably here, and the difficulty of making a satisfactory selection for the prizes was increased by the fact that some of the best-looking animals failed greatly in appearance of usefulness as breeders, and especially as milkers. In giving the preference to Mr. R. Thompson's extremely useful-looking dark roan cow, "Molly Millicent," the Judges quite carried public opinion with them, for practical men—and that section of the public who take an interest in cattle-judging are in the main decidedly practical—are always pleased to see utility in

the ascendant. "Molly Milicent" is one of many excellent Shorthorns of a thoroughly useful type, which have in recent years come out from the Inglewood herd. She was bred by Mr. Thompson, and got by his prize bull, "Beau Benedict" (42,769). She is well formed, level in the flesh, large in scale, and displays a rare udder. In character she is not so attractive as critics might wish, yet by some good judges she would have been preferred to "Lady Pamela" for the Champion prize.

A roan heifer, of an exceptionally good type, took the second place. This is Messrs. Hosken and Son's "Alexandrina 9th," a handsome well-haired heifer, of fine character, and much promise; winner of the second prize at Norwich last year. She is just a trifle light in the fore-rib, and might be better in the loin; but she is very good in the underline, and gains upon one on close inspection. She was bred by her owners, who have brought out many first-class Shorthorns, and got by "Grand Duke of Oxford 5th" (43,318). Mr. John Garne's famous prize-winning white, "Petted Pansy," was a popular third. She was truer in symmetry than any of the others, and carried a great deal of excellent meat; and if she had shown more appearance of udder, she could scarcely have been denied even a higher place. She was bred by her owner, and got by "Prince Frogmore Seal" (48,488). The Rev. Mr. Bruce Kennard's "Queen of the Isles"—first at Norwich last year—has fought many a battle with "Petted Pansy," and has often beaten her. Now the former is losing symmetry, being exceptionally wide and full along the top line, and rather light below. Still she is a big, massive heifer, with many good points. If she should breed, and develop a good udder, she would again be formidable in the Showyard. She was marked as the "reserve" here; was bred by her owner, got by "Montrose" (45,261) from the famous "Queen Mary" strain. The Judges considered the others so good that they commended the whole Class.

There were exactly the same number of entries (thirteen) of Two-year-old Heifers, and the Class, as a whole, was quite as strong in merit. "Whole Class commended" is the verdict of the Judges. As at Norwich last year, Mr. David Pugh, M.P., of Manoravon, took the lead with "Zoe 5th," a very stylish roan, of excellent character. When standing, she seemed a trifle low in the loin, but she is not really weak there; and her wonderful gaiety, wide, round rib, level flesh and choice quality, carried her easily enough into the highest position in the Class. Indeed, she made a very close run for the Champion Prize, which, we believe, at least one of the Judges felt strongly inclined to award to her—a decision which we think he could have well enough defended. She looked well in the judging-

ring; but it was in the parades that her beautiful form and character were seen to greatest advantage. She was bred by Mr. Pugh, and got by "Sir Charles" (44,020). Mr. R. Thompson's "Inglewood Gem" is quite as good in some points, being generally attractive in form, and specially good over the crops, but a little deficient in substance behind. She is likely to grow into a fine cow; was bred by her owner, got by "Royal Baron" (50,354), and out of the prize cow "Inglewood Belle" by "Beau Benedict" (42,767). Mr. T. E. Walker, of Studley Castle, got the third prize for "Princess Royal 6th," by "Fernandez 2nd" (49,582), winner of first prize at Bath and West of England Show at Dorchester, and second at Reading. Good as she is, however, we should have preferred the Duke of Northumberland's "reserve" heifer, "Rose of Borrowdale," a very thick, short-legged red and white, of excellent symmetry, bred by his Grace, and got by the Warlaby "Christon" bull, "Royal Mowbray" (42,330), which was used with admirable results by Mr. Richard Welsted, of Ballywalter, Co. Cork.

A very large Class of Yearling Heifers, containing twenty-five entries, made a very favourable impression both upon the Judges and the onlookers. The majority of the youngsters showed exceptional merit, and very properly the Judges commended the whole class. A very beautiful Waterloo heifer came, rightly enough, to the front — "Lady Oxford Waterloo 5th," shown and bred by Mr. P. A. Evans, Uffington, Shrewsbury, and got by "Viscount Oxford of Elmhurst" (48,892). She is rich roan in colour, handsomely made in front, exceptionally good over the crops, but not perfect in the hind-quarters. The second-prize heifer, "Honeybeam 5th," belonging to Mr. Walter, is much bigger, even with due allowance for difference of age, and she is likewise well formed, and likely to make a grand cow. Meantime she is not so feminine-looking as the one placed before her, but we should not be surprised if she should turn the tables in later years. She was bred by H.R.H. the Prince of Wales, at whose sale last year she was universally admired. She was got by "Geometry" (47,946), and is from the well-known "Honey" strain, of which Colonel Kingscote and others have some excellent representatives. The Marquis of Exeter's third heifer, "Charity," is a neat little roan of true symmetry, inheriting the famous "Telemachus" and "Sea Gull" blood. Sir John Swinburne's "reserve" heifer, "Waterloo Maid 7th," by "Duke of Oxford 69th" (49,475), is a very handsome red, very good over the crops, and exceptionally promising. A grand-daughter of the famous "Rosario" (35,315), which was sent all the way from Ross-shire by Mr. James A. Gordon, of Arabella, got well into

the list, in which there were several other valuable young heifers.

Report of the Judges of Shorthorns.

With the exception of the first prize animals, the *Bulls* generally were below the average standard of the Royal Agricultural Society's Show.

CLASS 62. *Cows.*—Only three animals exhibited; all of great excellence.

CLASS 63.—A very good lot; the whole class commended.

CLASS 64.—Numerous and good; whole class commended.

CLASS 65.—Twenty-five animals, many of exceptional merit; class commended.

H. CHANDOS-POLE-GELL.
G. DREWRY.
R. STRATTON.

HEREFORD CATTLE.

Hereford cattle, with their striking uniformity of colour and well-defined and deeply imprinted configuration, always make an imposing sight on parade. Good Herefords look well wherever seen; they look specially well amongst other cattle. At Newcastle the breed was well represented in numbers, although a few of the sixty-six entries were not sent. It was not the best display of Herefords we have seen; yet it reached a high standard of excellence, especially creditable so far from the home of the breed.

Three-year-old Bulls were included in the Class for Adult Bulls, which was limited, on the other hand, to five years. Mr. H. W. Taylor's celebrated "Maidstone" (8875), one of the grandest living bulls of any breed, came out once more in good form, and, in the absence of his old compeer, the Earl of Coventry's "Good Boy," which he has sometimes beaten, won easily. "Maidstone" has now, we believe, won over sixty first and Champion prizes. He is a lengthy, massive bull, with grandly-covered top, bred by Mr. Taylor, and got by his prize bull "Franklin" (6961). The second-prize bull, "Magnet" (8873), shown and bred by Mr. R. Edwards, of The Sheriffs, Kingston, is a thick, well-fleshed, four-year-old, exceedingly well covered along the back, and exceptionally strong in the loins. He was sired by "Marquis" (6057). The Earl of Coventry's three-year-old bull, "Rare Sovereign" (10,499), made a close third. He is a trifle light in the underline and fore-rib, but is thickly fleshed and very good along the top. He was bred by his Lordship, got by his well-known prize-bull, "Good Boy" (7668), out of "Rare Jewel," by that fine sire, "Merry Monarch" (5466).

Nine Two-year-old Bulls were entered, but two or three were absent. Those exhibited showed very high merit. Mr. W. Tudge's "Regent" (11,589) was undoubtedly one of the best

bulls in the Show. He is a little high at the tail-head, and might be better in the fore-rib, but he is big, thick, and massive, remarkably well developed in the loins, heavily fleshed, and of desirable character. He has won numerous prizes, including the first at Norwich last year, and would be hard to beat amongst animals of his age. He was bred by his owner, and got by "Regal" (9121), from "Rhea" by "Romulus" (5542). Mr. A E. Hughes, of Wintercott, had a creditable second in "Pirate" (11,531), a lengthy, well-shaped bull, of nice character and quality, just a trifle light in the thighs and flank. He was bred by Mr. Hughes, got by "Garfield 2nd" (7648), and out of "Purity" by "Royalist" (4921). The Earl of Coventry showed two very good bulls here, which stood respectively third and "reserve."

The Class of Yearling Bulls was of similar size and character. Mr. A. P. Turner, Pembridge, won the first prize for "Tarquin," a very deep, thick bull of a very useful stamp, heavy, but not quite even in flesh, with good neck and countenance. He was bred by Mr. Turner, got by "Sir Edward" (10,631), and out of "Kathleen" by the famous high-priced bull. "The Grove 3rd" (5051). The second-prize bull, "Alton," shown and bred by Mr. John Tudge, of Alton Court, is good in some points, rather attractive in the ring, but somewhat deficient in flesh and substance. He was got by "Leinthal" (8801), and out of "Coral" by "Maréchal Niel" (4760). Some would have preferred the Earl of Coventry's third bull, "Golden Miner," a lengthy, well-formed bull, slightly light in the fore flank, but very good over the crops.

As with Bulls, Cows of three years were classed with their seniors, and this mixing of youth and maturity made the duties of the Judges still more onerous. Ten entries with some absentees made up a strong Class of Cows. Mr. H. W. Taylor's "Gem" is aptly named. She is very handsome in form, thick, short in the leg, true in symmetry, and of fair size for a three-year-old. She is admirably ribbed, and thick in the flesh, and although there were bigger cows in the class, her victory was generally approved. She was bred by Mr. Taylor, got by "Franklin" (6961), and out of the fine cow "Modesty," by "Tredegar" (5077), so that she comes from prize-taking parents. Sir Joseph L. E. Spearman followed with "Myrtle 6th," a big, massive, well-shaped seven-year-old cow, very good over the crops, and well developed in the underline. Mr. A. E. Hughes came third with his well-known prize cow, "Sunflower," which in her younger years was very difficult to beat.

Two-year-old Heifers, of which nine were entered, made an exceedingly strong Class, all the ticketed animals showing

very high merit. Mr. Rees Keene, of Pencraig, took the lead with his grand prize-heifer, "Bangle," deep, thick, massive, well ribbed, heavily fleshed, and short in the leg, but not so even in the hind-quarters as could be desired. She was bred at Pencraig, and got by "Bangham" (6793), which has proved a valuable sire. Mr. W. T. Crawshay, of Cyfarthfa Castle, had a very good second in "Cyfarthfa Violet," a neat little heifer, of good symmetry, fine character, and excellent quality, bred by himself, and got by "Westbury" (8158), out of "Downton Violet" by "Downton Boy" (5877). Mr. A. E. Hughes got the third prize for "Blossom," a well-formed, wide-ribbed heifer, of much substance, bigger than the second, but barely so desirable in quality.

The Class of Yearling Heifers was larger (thirteen entries), and also of very high merit; a few of the heifers being exceptionally promising. Mr. John H. Arkwright, of Hampton Court, came to the front here with "Ivington Lass 24th," a very handsome heifer, deep in the body, short in the leg as all the good Herefords are, well ribbed, and carrying a remarkable amount of flesh for so young an animal—flesh of the right kind, too, and carried most thickly likewise where it is of most value. She is a little short in the hind-quarters, but is upon the whole a grand heifer. She was bred by Mr. Arkwright, and got by "Rose Cross" (7237). Good as this heifer is, however, she was very closely followed by "Gay Lass," shown and bred by Mr. H. R. Hall, of Holme Lacy. "Gay Lass" is also deep in the body, very thick and plump, and wonderfully true in symmetry. She was got by "Horace Cremorne" (10,085), and out of "Gay" by "Dale Tredegar" (5856). The Earl of Coventry obtained the third prize, as well as the reserve ticket, for "Rosewater" and "Camilla" respectively."

Groups of two Heifers and one Bull, all calved in 1886, of which there were four entries, formed a very interesting Class. The contest here was very keen, and all the groups were of high merit.

One notable feature in connection with the show of Herefords is well worthy of mention, and that is the very large proportion of animals exhibited by their breeders. Of the 38 Hereford animals to which tickets were awarded, no fewer than 36 were shown by their breeders!

Report of Judges of Hereford Cattle.

The Judges of Hereford Cattle have to report that, although small in numbers, their high character was well maintained. Classes 70 and 71 were especially commendable, and contained some animals of particular merit.

J. Bowen-Jones.
Aaron Rogers.

Devon Cattle.

The Judges of Devon cattle, strongly as they commend the display, have in no way over-estimated its character. An entry of 31 animals, so far from the home of the breed, is fairly creditable. But the most striking feature in the muster of Devons was the very high standard of excellence. The Judges are, we believe, right in saying that it has never been surpassed at the Royal Show.

Bulls from two to five years old were classed together. Nine were entered, but three did not put in an appearance. The other six contested keenly. Viscount Falmouth's first-prize bull, "Lord Wolseley," is a thick, plump, three-year-old, with admirably sprung rib, exceptionally good in front, well-filled back from the shoulder, but rather short in the hind-quarters, and light in the thighs. "Lord Wolseley" was bred by his noble owner, and got by "Cairo" (1690). Mr. Richard Bickle, of Bradstone Hall, had a good second in "Champion" (1696), a handsome four-year-old, also rather short in the hind-quarters, but admirably covered on the loin, well ribbed, and of desirable character; bred by the late Mr. H. Davy, Penhole House, Launceston, and got by "Champion" (1522). The third prize went to Mr. A. C. Skinner for his well-known prize bull "General Gordon."

Again, in the Yearling Bull Class there were exactly half-a-dozen entries, and Mr. John Howse, of Leighland, had an excellent first here in "The Vicar," a very nice, straight, attractive bull of great promise, just a trifle light in the fore-rib; bred by his owner, and got by "Druid" (1317). The others contested keenly, and they all received tickets. The second prize also fell to Mr. John Howse, for "Lord Leighland 2nd," likewise got by "Druid." He is small in size, but well made, and of good quality.

The Cow Class, with five entries, was very strong in merit. It was headed by Mr. A. C. Skinner's grand cow, "Moss Rose 8th," which amongst many other victories won the Champion Prize over all breeds at the Royal Counties Show at Reading this year. She is a wonderfully thick, short-legged, heavily fleshed animal, of rare symmetry, and excellent feminine character. Like many other good Devons, she was bred by the late Mr. Walter Farthing, and got by "Lord Stowey" (1601). Mr. Walter's "Norah 7th" (7171), made a very creditable second. She is a very big, deep, heavily fleshed four-year-old cow, of a useful type, scarcely so neat as some of the others. She was bred by John Surridge, and got by "Lord Currypool" (1589).

Sir W. Williams, Bart., got the third prize for "Flame," a short, plump, well-ribbed four-year-old, of good character but rather uneven in flesh.

The Class of Two-year-old Heifers was of similar size, and also of exceptional merit. The Judges highly commended the whole of this class. The winners were very close in point of merit. Sir W. Williams takes the lead with "Frantic," a very thick, plump, short-legged heifer, of true Devon character, but rather high in condition; bred by himself, and got by "Duke of Flitton 17th." Her Majesty the Queen had an excellent second in "Fanciful," a big well-made heifer, on a wider scale than the first, but not quite so neat. She was bred by Her Majesty and sired by "Lord Currypool."

The Yearling Heifer Class also had five entries, and again the Judges felt constrained to mark "the whole highly commended." Mr. Walter won the first prize here with "Buttercup 5th," a very pretty little plump heifer of his own breeding, and got by "Lord Stowey" (1601). Mr. A. C. Skinner's second, "Myrtle 23rd," by "Lord Currypool," is also pretty, very good in front, but just a trifle light in the rib, where, however, she may gain strength.

Report of Judges of Devon Cattle.

In the Devon Cattle, Class 73 produced six animals of exceptional merit; and whilst we may have seen better animals than either, as a class we have never seen them surpassed. The merit in some cases was very equal, whilst we felt called upon to highly commend the whole class.

Class 74.—This was a useful class of youngsters, the first-prize animal having an easy win, whilst the other prize-winners had a close run.

Class 75.—Here we had perhaps the best animal that came under our notice, in No. 684, which took a good lead, and is a grand cow of good Devon type, with her flesh very evenly laid on; whilst she is followed by two good cows, Nos. 682 and 687, the former a cow of great depth and substance; whilst the latter, of good type, does not carry her flesh so evenly.

Class 76.—In this class some difficulty was experienced in consequence of the great merit in the animals exhibited, and here again the whole class is highly commended.

Class 77.—This was a very nice class, being again without exception highly commended. And here we would remark that the Devons as a whole present one of the grandest displays ever made by this breed at the "Royal." Their being so far from home the numbers are naturally not large; the merit, on the other hand, is of a very exceptional order, not one plain animal having come under our notice.

In recommending the third prize to be given in some cases where the class was not sufficiently large to otherwise carry it, we were actuated by the high merit exhibited, and in some cases the very close contest between the second and third animals.

Saml. Kidner.
Richd. Hamshar.
George Napper.

Sussex Cattle.

Of this very useful and rising breed there was a small but creditable display. As yet the breed is confined mainly to the southern county from which it takes its name, so that in the extreme north of England a large collection could not have been expected.

Only three Bulls appeared in the Class for Two, Three, Four, and Five-year-olds, but these were of satisfactory merit. Mr. Joseph Godman, Park Hatch, Godalming, came first with "Nobleman" (707), a big, massive, three-year-old, of great substance, very long in the frame, and well fleshed; bred by himself, and got by "Napoleon 3rd" (396). Mr. W. S. Forster got the second prize for "Mikado" (705), a thick, short-legged, three-year-old, slightly wanting in quality, bred by Mr. A. Holmes, Rye, and got by "Steyning" (729), a son of the famous "Goldsmith" (391).

Again, in the Yearling Bull Class only three animals came forward. Mr. Stewart Hodgson had a good winner here in a very useful bull of nice character and quality, bred by himself, and got by "Frankfort" (671). The Aylesbury Dairy Company's second-prize bull, "March," is seven months younger than the one placed before him, but although he is therefore small, he is very neat and promising.

There was a larger and stronger Class of Cows or Heifers in Calf or in-Milk. The first prize went to Mr. W. Blanford Waterlow, of High Trees, Redhill, for "Elsa," a well-formed three-year-old cow, fine in the bone, of good symmetry, and well fleshed, but a little short in the hind-quarters; bred by himself, and got by "Wallace" (478). Mr. J. Stewart Hodgson's second cow, "Laura 7th," is a big, useful animal, slightly weak in the loin, bred by himself, and got by "Lord Oxford" (461).

Two-year-old Heifers were few in number, only four having been entered, but the two prize-winners showed high merit. Mr. Joseph Godman's first is "Noble Lady 2nd," a handsome, well-shaped heifer, with very good underline, but just a little light in the fore-rib; bred by himself, and got by "Goldboy" (541). Mr. W. S. Forster's second heifer, "Glory," is smaller, but neater; bred by himself, and got by "Mabel Bull."

A large and very good Class of Yearling Heifers was headed by a very straight stylish heifer of much promise; shown and bred by Mr. W. S. Forster, and got by "Mikado" (705). Mr. Joseph Godman's second, "Comely 9th" (3683), is also a very promising heifer, but not so very neat in her hind-quarters.

Report of the Judges of Sussex Cattle.

The Royal Show being held in the most northern county of England, and Sussex being so far south, the breed which takes its name from that county was not largely represented, the distance doubtless deterring many breeders from entering their stock; and the Judges express their regret at the smallness of the entries (in some of the classes) of this very useful breed, and they can but hope that the number of exhibits may increase from year to year.

In Class 78, for *Aged Bulls*, although only three came before us, all were good representatives of their respective herds; and after careful consideration we awarded first prize to No. 700, a bull of great substance and weight. The second prize was given to No. 699, a very short-legged bull, but not quite so good to handle. The reserve, No. 701, was of great size and good flesh, but rather too flat in his ribs.

Class 79 again brought only three before our notice, but there was no difficulty in awarding first prize to No. 705, a promising young bull from the well-known Lythe Hill herd. The second, No. 704, laboured under the disadvantage of being six months younger, and we were pleased to find afterwards that he was sent by fresh exhibitors, the Aylesbury Dairy Company, a society from whom farmers hope much from the impulse they will give to the breeding and rearing of cattle in general. The reserve, No. 703, calls for no particular comment.

Class 80. For *Cows or Heifers.*—We awarded first prize to No. 707, a grand heifer with her first calf, showing a great deal of substance and good breeding, and one of the best animals of the breed exhibited. The second prize went to No. 712, a useful animal.

Class 81 brought a short number. We placed No. 716 first, and No. 715 second, both being of good type, and who would doubtless have held their places amongst a larger number.

Class 82 brought into the ring seven very promising young *Heifers*, and it took some time to decide as to their respective merits. We ultimately placed No. 721 first, a nice level heifer, with good quality; No. 723 second, not quite so well shaped in her rumps. The reserve went to No. 718; and we felt obliged, from their general excellence, to commend the whole class.

Saml. Kidner.
Richd. Hamshar.
George Napper.

Red Polled Cattle.

Thirty entries, with only two absentees, must be considered a creditable representation of the Red Polls of Norfolk and Suffolk. It is, of course, very small compared with the enormous display of the breed at Norwich last year. In merit, however, the muster was very satisfactory.

A well-filled Class of Old Bulls was headed by Mr. J. J. Colman's "Don Carlos" (659), which stood second to the famous "Falstaff" (since sold to go to the United States for 200*l.*) at Norwich. "Don Carlos" is a very big, massive, well-proportioned animal, just a trifle light in the back-rib, but very long and wealthy in the frame. His breeding is as good as can be. He is by "King Charles" (329), whose sire, "Davyson 3rd,"

was purchased in the auction-ring for 215 guineas when nearly ten years old; and on the dam's side he comes from the famous "Norfolk Duke" strain, which has produced many prize winners, and excellent milking cows. Mr. W. A. Tyssen-Amherst, M.P., of Didlington Hall, took the second prize with another descendant of the "Davy" stock, namely, "Didlington Davyson 2nd" (657), got by "Davyson 12th, and out of "Davy 24th," a well-known prize cow.

Only three Yearling Bulls were entered. Mr. John Hammond, of Bale, Dereham, came first here with "Davyson 26th;" a very nice straight little bull of his own breeding, first winner at the Norfolk Show. The Duke of Hamilton followed with "The Prince," a pretty little youngster tracing from the "Bettenham" strain.

The Class of Cows was well filled with six good animals, one of the seven stalls being empty. The first prize here went to Mr. Tyssen-Amherst for "Emblem," a very well-shaped cow, just a little weak in the loin and sharp in the hooks; bred by himself, and got by the 215-guinea bull "Davyson 3rd" (48). She is only three years old, and was first amongst two-year-olds at the Norwich Royal last year. Mr. John Hammond had a very good second in "Davy 44th," got by "Davyson 7th"(476).

Eight Two-year Heifers made up a fairly strong class. Mr. John Hammond had an easy enough winner here in "Davy 64th," thick, deep, handsome, and well-developed, both in the top and underline; bred by himself, and got by "Roland" (739). The second prize went to Mr. Colman for "Silent Belle," a small but promising "Silence" heifer of nice quality, bred by himself, and got by "Haman" (499).

Five good Yearling Heifers were shown, and they all received tickets. Mr. Colman's first-prize winner is "Midget," quite a little gem; bred by himself from the same foundation as "Don Carlos." Mr. John Hammond's second is still another "Davy"—"Davy 73rd," a sweet little heifer by "Davyson 18th." The reserve ticket went to the Aylesbury Dairy Company for "Curzon Caroline 2nd," a very nice promising heifer, bred by its owners, and got by "Lancer" (689), a son of the 200-guinea bull "Falstaff," and from a strain which can be traced back to cattle on the Elmham property 120 years ago.

Report of Judges of Red Polled Cattle.

Considering the distance from home, the Red Polls were well represented in most of the Classes. There were only two absentees. The *Old Bull* Class contained two or three magnificent animals, the first-prize bull being a grand specimen of the breed.

The *Yearling* Class compared very unfavourably with the Old Class.

The *Cow* Class contained six animals, all being of considerable merit, the prize-takers showing unmistakable signs of being good milkers, as well as possessing beef-making properties.

The *Two-year-old Heifers*, as a whole, presented a very good appearance. The first-prize animal, however, had an easy victory.

The *Yearling Heifers* were fairly good, the first prize being a very attractive animal.

CHARLES HOWARD.
ROBT. WALKER.

POLLED ABERDEEN-ANGUS CATTLE.

The progress which this breed has made since the Royal Show at Newcastle in 1864 has been remarkable. It was then represented by about a dozen animals—(animals of rare merit they were, *vide* the report of Mr. J. Dent Dent, in vol. xxv., 1st Series, of the 'Journal')—sent from the native districts of the breed. On this occasion no fewer than forty-four entries, out of a total of seventy-five, were sent in from Polled Aberdeen-Angus herds, which have been established in England. The breed has taken a firm hold in the North of England, where valuable breeds of it are maintained by Mr. Clement Stephenson, of Sandyford Villa, and Balliol College Farm, Long Benton, Newcastle-on-Tyne; Mr. Owen C. Wallis, of Bradley Hall, Wylam-on-Tyne; Mr. Arthur Errington, of South Ella, Hull; Major H. F. Dent, of Ainderby Hall, Northallerton; Mr. W. G. Dickinson, of Elsternwick Hall, Hedon, Hull; Major Godman, of Great Smeaton, Northallerton, and others. Mr. Clement Stephenson has cultivated the breed with great enthusiasm and success, and his Showyard victories with the phenomenal "Luxury," "Lady Victorine," and others, have done much to spread the fame of the northern Polled cattle throughout England.

Not infrequently we have seen a finer display of the breed than there was at Newcastle. Taken as a whole, however, it was of a creditable character, and seemed to elicit a good deal of admiration from visitors. There were eight entries of Bulls calved in 1882, 1883, or 1884; but one or two of the stalls were empty. Lord Tweedmouth's very handsome young bull, "Cash" (4558), was quite a clear winner. In age he competed at a disadvantage, for he was calved about the closing days of 1884; but his admirable form, excellent quality, great substance, wealth of flesh, and attractive character, at once carried him to the front. He won in the Yearling Class at the Highland and Agricultural Society's last year; was Champion at the Aberdeen Show this year, and here, besides the first in his class, he was awarded the Special prize for the best Bull of the Breed. Bred by his noble owner, and got by "Mosstrooper" (2256), he is out of "Frailty" (4932), by the Ballindalloch prize-bull,

"Judge" (1150). Mr. Clement Stephenson's second-prize bull, "Evander" (3717), is a lengthy, stylish, three-year-old, of excellent quality, somewhat slack in the middle; bred by Sir George Macpherson Grant, Bart., of Ballindalloch, out of the "Erica" cow, "Evening" (4187), and got by the "Jilt" bull, "Julius" (1819). He, too, has been in former prize-lists, and is also useful in the herd. The third prize went to Mr. Thomas Smith, Powrie, Dundee, for "Norfolk" (3082), a thick, deeply-fleshed, five-year-old bull, of the old Angus "Doddie" type, being more rounded in his points than the two placed before him.

The Class of Two-year-old Bulls was fairly well filled. Here again Lord Tweedmouth provided the winner. His first-prize bull here is "Despot of Guisachan" (5289), a big, good-looking, nineteen-month bull, with remarkably good underline, and also of desirable quality, though not quite so level along the back as could be desired. He too was first at Aberdeen; was bred by Lord Tweedmouth, got by the "Pride" bull "Apollo" (2456), and out of "Morcar" (6216), by the "Erica" bull "Ethelred" (1440). He was afterwards sold for exportation to South America. Major H. F. Dent's second prize bull, "Janus," is rather older and thicker, and also well shaped, and carried a good deal of flesh. He was bred by Sir George Macpherson Grant, Bart., got by "Bushman" (2011), and from the "Jilt" cow "Judy" (2996). Mr. Owen C. Wallis followed closely with a lean, lengthy, useful-looking bull of nice quality, bred by Mr. Scott, of Easter Tulloch, Stonehaven, Kincardineshire, and got by "Davie" (2046).

A very good Class of Yearling Bulls was headed by a very promising youngster shown by Mr. Mackenzie, Dalmore, Ross-shire. He is handsome in form, of admirable quality and character, and promises to grow into a very fine sire. His descent is of the choicest. Bred at Ballindalloch, and got by the first-prize bull "Iliad" (2843), he is out of the fine "Erica" cow "Ella," whose sire was the Champion "Erica" bull "Young Viscount" (736). The Earl of Strathmôre had a very creditable second in "Siberian," a neat, well-made bull of considerable substance, and also of nice quality. He was bred by himself, out of that beautiful prize cow "Sybil 4th" (4326), and got by "Provost" (1259), whose dam was that famous "Pride" cow "Pride of Mulben" (1919), for which a good many years ago Sir George Macpherson Grant gave 91 guineas at the dispersion of the Mulben herd. The third prize went to Miss C. H. A. Morison Duncan, of Naughton, Fifeshire, for "Pride of War," a neat, plump, well-shaped bull of considerable promise, just a trifle light in the rib.

The Class of Cows was one of the strongest in the Section. There were no fewer than twenty-one entries, and amongst them were at least half-a-dozen cows of exceptional merit. Mr. Clement Stephenson's "Lady Victorine" has improved in feminine appearance since last year, when amongst other important victories she beat Mr. T. H. Hutchinson's famous Shorthorn cow "Lady Pamela." She is very handsomely formed, of true Polled type, desirable quality and character, and walks gaily; but when standing, she is not quite level on the back, while she might be better in the head. She was bred by the Hon. Charles Carnegie, and got by "Royal Victor" (1780). Mr. T. Smith's second cow, "May 8th" (7750), is thicker and deeper in the carcass, and carries a good deal more flesh. The Judges hesitated long between the two, for there is much to be said in favour of both, and had the Powrie cow been a little more level in the loin and rump, the result might have been different. "May 8th" is also a noted prize winner. She was bred by her owner, and got by the prize bull "Monarch" (1182). The third prize went to Her Majesty the Queen for "Princess Irene," a big, long, massive five-year-old, bred by Her Majesty, and got by "Prince Victor of Daugh" (1865).

Two-year-old Heifers were fewer in number, and not equal to the Cows in merit. Mr. Clement Stephenson's first heifer, "Pride of Englishman" (10,580), is a good-looking well-ribbed heifer, very good over the crops, winner of the second prize at the Highland Show last year. She was bred by himself, and got by the Ballindalloch "Erica" bull "Englishman" (2076). Miss C. H. A. Morison Duncan came second with "Melissa Grace" (10,569), a smaller but more compact heifer, bred by the Earl of Southesk, and got by "Sylvio" (3281). Mr. Owen C. Wallis got third and reserve for two good heifers of his own breeding.

The Class of Yearling Heifers was both large and of high merit. The best half-dozen of the eighteen entries contested very keenly. Mr. Clement Stephenson again came to the front, this time with an animal of exceptional merit and promise, namely, "Fanny of Benton" (11,769), a straight, truly made heifer of admirable character and quality, and the best of feminine features. She was bred by himself, got by "Sheik" (4290), and out of "Fanny of Boghead" (3341). She was a popular winner in her class, and after considerable hesitation the Judges likewise awarded her the Special prize for the best Female of the Breed, an honour which perhaps the majority of the onlookers expected to go to Mr. Stephenson's first-prize cow, "Lady Victorine."

No animal in the Section showed better character or more promise than the second-prize yearling heifer exhibited by Mr. George Smith Grant, Auchorachan, Glenlivet. She is lean in condition, but is admirably formed, and looks like growing into a fine cow.

Report of the Judges of Polled Aberdeen-Angus Cattle.

Class 88. *Aged Bulls.*—This was a good class all over, the first-prize bull being an animal of great style and substance for his age; the other prize animals being of considerable merit.

Class 89. *Two-year-old Bulls.*—Though a creditable lot, these were not up to the excellence of the aged bulls.

Class 90—*Yearling Bulls* were a very good lot, exhibiting style and tone of high breeding, especially the placed animals.

Class 91—*Cows* were an exceptionally good lot. Any of the ticketed animals would make a creditable first in any Showyard.

Class 92—*Two-year-old Heifers* lacked the merit of the former class.

Class 93—*One-year-old Heifers* were numerous and very good. So much so, that in this class was found the Champion of the Show for the best Female.

John Grant.
William Whyte.

Galloway Cattle.

The display of Galloway cattle was undoubtedly the best ever seen in an English Showyard. There were sixty-five entries, and very few of the stalls were empty. The Cow and Heifer classes were exceptionally strong, and at the parades these classes were conspicuous for the depth, thickness, and symmetry of the animals. The breeders of Galloway cattle are indeed to be congratulated upon the excellent appearance made by their fine beef-producing stock.

The Class of Adult Bulls, with ten entries, was well filled, being quite up to the average of leading Scotch Shows in merit. All the prize animals showed much excellence. The Duke of Buccleuch and Queensberry took the lead with "Kinsman 2nd of Drumlanrig" (1790), the fourth-prize winner at the Dumfries Highland Show last year. He was bred by his noble owner, and got by "Harden 2nd" (1458), and is a big, handsome, good-looking five-year-old, carrying a good deal of flesh. Mr. James Cunningham's second bull, "Lucky Times" (3058), is a thick, well-formed, four-year-old, with less of the characteristic Galloway hair, good on the crops, but not quite even in flesh. He was bred by Mr. R. Webster, Airds, New Galloway Station, Kirkcudbright, and got by "Spring" (1582). The third prize went to Messrs. P. Morton and Sons, of Pedderhill, for "Canny Scot of Kirkhill," a big, level, deep-bodied four-year-old bull of a thoroughly useful stamp.

Two-year-old Bulls were fewer in number, but the leading winners were animals of very high merit. Sir Robert Jardine's first-prize bull, "Liberator of Balig" (3850), is an exceptionally handsome bull, long, level, and well-proportioned, stands nicely on his legs, well covered with flesh, might be better on the loin and fore-rib, but admirable in quality and character. He was bred by Messrs. R. and J. Shennan, Balig, Kirkcudbright; got by "Liberty of Balig," and out of "Lucy of Balig 11th." The Special prize for the best Bull of the Breed was awarded to him. Mr. F. E. Villiers had a close second in "Dictator" (3845), a short-legged, thick, handsome bull, heavily fleshed, and of desirable character and quality, just a little prominent at the shoulder points.

The Yearling Bulls were moderate as a lot. The Duke of Buccleuch and Queensberry's came first, with a very nice little bull of admirable character and quality, but wanting depth. He was bred by Mr. F. E. Villiers, got by "John Highlandman" (1905), and rejoices in the imposing name of "Vich Jan Vohn of Closeburn" (4121). The Rev. John Gillespie's second bull, "Lord John Scott" (4374), is more lengthy, and likely to grow into a bigger animal, but is scarcely so neat or so attractive in character. He was bred by the Duke of Buccleuch and Queensberry, and got by the first-prize old bull, "Kinsman 2nd of Drumlanrig" (1790).

About a dozen Cows of very high average merit came before the Judges, and amongst the best four or five the contest was very keen and interesting. The first prize ultimately went to one of the finest young cows in the Show, which was later in the day declared the best female of the Galloway breed. This is Mr. F. E. Villiers's "Vaudeville of Closeburn," a very deep, thick, short-legged, three-year-old cow, wide in the rib, very good on the crops, with nice neck, and heavily fleshed, but not quite so strong in the loins as could be desired. She was bred by Mr. Villiers, and got by "John Highlandman" (1905). Sir Robert Jardine got the second and third prizes for "Netty of Culmain" (4240), and "Braw Lady" (8805), a pair of thick, short-legged, heavily-fleshed, young cows, of a very useful type. The former was bred by Mr. Maxwell Clark, Culmain, and got by "Competitor" (1784), and the latter by Mr. R. Webster, Airds, and got by "Osman Pacha" (1282).

Two-year-old Heifers were still more numerous, and also of very high merit. Sir Robert Jardine came to the front here with "Marigold" (9540), a very handsome heifer, stylish and promising, wide and deep in the frame and nicely haired. She was bred by Mr. Andrew Montgomery, of Nether Hall, and got by "Competitor" (1784). Sir Robert also got the third

prize for another well-made heifer of Mr. Montgomery's breeding, sired by "Statesman 2nd of Drumlanrig" (1786). She is well-grown and handsome, but scarcely so wide in the rib as the first. Messrs. Thomas Biggar and Sons obtained the second prize for "Caprice 3rd" (9500), a beautiful heifer, of rare quality and character, straight and symmetrical, and also of much promise. She was bred by themselves, and got by "Crusader" (2858).

The Class of Yearling Heifers was equally good, and here again there were very close contests for all the positions. Sir Robert Jardine once more came to the front, curiously enough this time also with a heifer bred by Mr. Andrew Montgomery, namely, "Rose Royal," an exceptionally pretty little heifer, deep, thick, and symmetrical, with grand underline, just a trifle high at the tail-head. She was got by "Queensberry 4th" (1785), and promises to grow into a rare cow. Messrs. Biggar and Sons followed closely with "Cantatrice 4th" (10,087), another of "Crusader's" produce. She is quite a little beauty, small, but young, and almost perfect in form, with admirable quality and character. The third prize went to Mr. James Cunningham for "Violet 3rd of Tarbreoch" (9675), a thick, well-grown heifer of considerable substance.

Report by the Judges of Galloway Cattle.

We have to report that the handsome prizes given by the Society have brought together a very fine exhibition of *Galloway* cattle.

The *Old Bull* Class are of average merit. In the *Two-year-old* class the first and second prize animals are of exceptional merit. To the first prize animal in this class we awarded the Champion Prize for males. The *One-year-old Bulls* are rather an uneven lot, the first-prize animal having an easy victory.

In the *Female* Classes we were agreeably surprised to see so many good animals on this side of the Border. The first-prize *Cow*, which is also Champion prize winner, is an extraordinarily good cow, and the three others following are really fine cows. The *Two-year-old Heifers* display all the good qualities of the breed, and were not an easy lot to place; and the same remark will apply to the *One-year-old* Class.

William Graham.
James Little.

Highland Cattle.

This was perhaps the only disappointing Section in the Show. Two or three very good representatives of the shaggy West Highland race were sent by the Duke of Sutherland, but there were in all only eight entries of the breed. The Duke of Sutherland's first-prize bull, "Rob Roy," is a well-formed nine-year-old red, of good character, bred by Mr. D. McLaren, Corrychrone, Callander, and sired by "Duke of Athole." The

second prize went to his son, "Glen Dhu," a very good two-year-old black, bred by his Grace. Mr. George Sampson's third-prize bull is a fairly good four-year-old black, bred by Mr. Lawrie, Fincharn.

The Duke of Sutherland's first-prize cow, "Tarrqheal," is a handsome three-year-old of true Highland character, bred by his Grace. Mr. George Sampson got the second and third prize for fairly useful cows of unknown breeding.

Report of the Judge of Highland Cattle.

Class 100.—The exhibits were not numerous, but the quality was excellent, especially the first and second prizes.

Class 101.—This class, with the exception of the first-prize animal, were only of fair merit, but the first prize would hold her position in any Showyard.

Duncan McDiarmid.

Ayrshire Cattle.

The Judges of Ayrshire Cattle report in unqualified terms as to the high character of the muster of this valuable dairy breed; and breeders of Ayrshire cattle may well congratulate themselves on such testimony as this from gentlemen than whom there are no higher authorities. There were thirty-two entries of the breed, and the classes were all distinguished by exceptionally high average merit.

Four excellent Bulls, calved in 1882, 1883, or intervening years, came before the Judges, most of them noted winners. Mr. Osborne's first-prize bull, "Cock a' Bendie," is a very good-looking three-year-old, well grown, straight in form, deep in front, and of true character. He was bred by his owner, and got by the famous bull "Hover a Blink" (892), and was afterwards awarded the Special prize for the best Bull of the Breed. Mr. R. Wardrop's second bull, "Ayrshire Lad of Garlaff," is a year younger, and of course smaller in size, but is equally well-formed and of beautiful quality. He was bred by his owner, and got by "King Coil" (431). The third prize went to Mr. Mark J. Stewart, M.P., for "White Prince" (909), a big, useful-looking four-year-old bull, bred by Mr. P. M. Coul, Wattiestan, Kilbirnie, and got by that well-known sire "Baron o' Bucklyvie" (281). The famous prize bull "Silver King," the Champion Ayrshire bull at several former Shows, and now shown by Mr. E. A. Roberts, of Greenhithe, Kent, has lost freshness somewhat, and was left with the "reserve" ticket.

The Class of Yearling Bulls was larger and also contained high merit. Mr. R. Osborne again came to the front, this time with "Crags of Kyle," an exceedingly pretty bull of nice character and much promise. He was bred by Mr. Andrew

Logan, Overton, Coylton, Ayr, and got by "Sam." As in the older class, Mr. R. Wardrop followed closely with "King Charlie of Garlaff," a very handsome little bull of choice character and quality, not quite so fresh-looking as the one placed before him. He was first-prize winner at Ayr, was bred by Mr. John Weir, Shield Mains, Coylton, and got by "Mequittiston Bob." Mr. R. Wilson's third-prize bull is bigger and also well formed, but not equal in quality to the two placed before him.

The Cow Class, very good as a whole, contained a few animals of rare merit. Mr. Mark J. Stewart's first-prize cow, "Bertie 2nd" (3217), has won numerous honours, and was here awarded the Special prize for the best Female of the Breed. Bred by Mr. Robert Meikle, Clockston, Tarbolton, Ayrshire, and got by "Pride of Clerkland," she is an exceedingly handsome and useful cow, with grand underline, well-formed udder, of true Ayrshire character and quality. Mr. John Holm's second cow "Annie," bred by himself, and by "Prince Alfred 2nd" (651), is a very good useful-looking cow, but it was generally expected that the second prize would have gone to Mr. R. Wilson's bigger and better made cow, "Yellow Bess" (2830), which came third.

Four excellent Two-year-old Heifers contested keenly. Mr. R. Wilson's first is "Lady Bright," bred by Mr. James Wilson, Macherquhat, Colmonell, Ayr, and got by "Neil Gow" (1076); neat, straight, and well topped, but just a trifle light behind. The second winner, from the same herd, is also well formed and exceptionally promising, with beautiful quality and character. She was bred by Mr. John Allan, Lambroughton, Kilmains, and got by "Bold Briton" (1483). Mr. Mark J. Stewart got the third prize for a big good heifer, rather high in condition, bred by Mr. Osborne, Drumjoan, Ayr, and got by "Hover a Blink" (892).

The Yearling Heifers were more numerous and equally high in merit. Mr. John Holm came to the front here with "White Rose," a well-grown, handsome heifer of much promise, bred by himself, and got by "White Prince 2nd" (1138). Mr. R. Wardrop's second winner, "Snowflake 3rd of Garlaff," is quite a little beauty, very young, but exceedingly handsome and promising, bred by himself, got by "Hover a Blink" (892), and out of "Snowflake 2nd" by "King Coil" (431). It is thus as choice in its breeding as in character.

Report of the Judges of Ayrshire Cattle.

We, the undersigned, having had the honour of acting as Judges of Ayrshires at the Royal Agricultural Society's Show at Newcastle, have

pleasure in reporting that the five classes contained some of the choicest specimens of the breed that have ever come under our notice in judging. As one of the Judges (Mr. Allan) has had the honour of acting at several of the Society's Shows, he is of opinion that it was the best ever held under its auspices as regards *Ayrshires*. In the *Aged Bull* class all four animals were splendid specimens of the breed; as were also the *One-year-old Bulls*, especially the first-prize one. The *Cows in-Calf or in-Milk* were all very fine animals; and the *Two-year-old Heifers* were such a splendid lot, that any of them was well worthy of a first prize at any Show in their native county. The *One-year-old Heifers* were also a very good class.

On the whole, Ayrshire breeders are to be congratulated on the splendid show they made amongst the various breeds of cattle.

ANDREW ALLAN.
JAMES MCQUEEN.

JERSEY CATTLE.

It was gratifying to the many and ever-increasing admirers of this beautiful milking breed to find it so well represented at Newcastle. For several years past the Jersey classes have formed a striking feature in the Royal Show; and this year, considering the distance of Newcastle from the southern counties to which as yet the breed in this country is chiefly confined, the display was most creditable, alike in numbers and merit. We are indebted to the Judges of Jersey cattle for a very interesting detailed Report, which considerably lightens the task of the present writer.

There has lately been much discussion as to the preference which has usually been given in shows to animals of what is spoken of as the "Island type," and as to whether or not it is possible or desirable, in the colder and more changeable climate of England, to maintain that thin, refined, and somewhat delicate appearance which constitutes the ruling character of the "Island type", as distinguished from the slightly more fleshy, more robust appearance of typical English-bred Jerseys. We do not intend to enter into this controversy here further than to say that we believe the discussion has already done good, by guarding breeders and judges against extremes of both types, and inducing them to keep in view the different climatic conditions in which Jersey cattle must live in England as compared with their native Island, and at the same time to insist upon the maintenance of those rare milking properties upon which rests solely the fame and value of the Jersey.

There has in recent years been great improvement in the general class of Jersey cattle bred in England; a gradual advancement in form, character and quality, so that the "rank and file" of English-bred Jerseys approach more nearly to the desired type, and possess in greater degree than in former years the distinguishing attributes of the well-bred Island Jersey

This improvement has perhaps never been so well manifested as at Newcastle, where home-bred Jerseys held their own very creditably. There were 101 entries of the breed. Of the twenty-one prizes awarded, English-bred cattle won ten—four first, three second, and three third prizes. In competition with the finest animals the Island could produce, this record is by no means discouraging to English breeders.

Of the fifteen Adult Bulls entered, only one was absent, and the class as a whole was exceeding good. Once again Mr. S. H. Hyde's famous "Dog Fox" came to the front. He is a beautiful three-year-old silver grey, unusually handsome in form and of desirable character and quality; not so rich in colour as some of the others, yet upon the whole an admirable stamp of a Jersey sire. He was bred by the late Mr. Cardus, Southampton, in whose herd there was some choice material. His sire was "Baron Lionel" (994), and his dam "Vixen" by "Dairy King" (211). He was third at the Norwich Royal last year, but has been Champion at other leading Shows. The Hon. C. R. G. W. Bampfylde's "St. Mary's King," which was second at Norwich last year, again occupied that position. He too is handsomely made, shows nice quality and is richer in colour than "Dog Fox;" indeed it was almost a "toss up" between the two. "St. Mary's King" is also four years old, was bred by Mrs. Jean Carabin, St. Mary's, Jersey, and got by "Augurez King" (1317) E.H.B. The third prize went to the Duke of Portland for the handsome three-year-old dark grey bull "Fun," bred by Mr. George Simpson, of Wray Park, Reigate, and got by "Farmer's Joy" (1075) E. H. B.

The Class of Yearling Bulls was still larger, and also of high merit. Mr. P. H. Fowler had a very good first in "Blue Khedive" (956), J. H. B., bred by Mr. Le Brocq, St. Ouens, Jersey. He is big, straight, handsome, stylish, and rich in colour, but just a trifle "throaty." The second prize went to Mr. H. J. Cornish (who has owned some of the choicest Jerseys ever seen in England) for "Bendigo" (895), J. H. B., bred by Mr. F. Le Brocq, St. Peter's, Jersey, and own brother to Mr. James Blyth's beautiful prize-cow, "Perry Farm Deery."

About a dozen excellent Dairy-cows competed in the Class for Cows Four-years-old or upwards, in-milk or in-calf. The first prize went to that most useful cow, "Bragga," the property of Mr. H. J. Cornish, and the winner of numerous prizes, including first at Norwich last year. She is six years old, was bred in Jersey by Mr. J. Allier, and got by "Cetewayo;" is not quite even in the loins, but is otherwise handsome in form, of true feminine character, and great appearance of usefulness. Mr. George Simpson's second cow, "Bessie," third at

Norwich last year, and a winner at several other Shows, looked well here, her excellent udder being much admired. She, too, was bred in Jersey—by Mr. P. Mourant, St. Saviour's—and is a very useful type of a cow. The third prize went to the Hon. C. R. G. W. Bampfylde, for "Lady Nina," a big, good, useful kind of a cow, imported, but of unknown breeding.

The Three-year-old Cows, also numbering about a dozen, likewise made up a creditable class. Mr. George Simpson's grand heifer, "Rosy 3rd," was a clear enough winner, good as the others are—indeed it will be seen that the Judges considered her about the best female of the breed in the Show, and that is saying a good deal. She was bred by Mr. Simpson, and is out of that beautiful cow, "Rosy" (512), J. H. B., and got by "Wolseley" (401), J. H. B. Besides being handsome, and of choice quality and character, she gives great promise of usefulness in the dairy. The second prize went to Mr. S. H. Hyde for "Geranium," another beautiful young cow, of admirable style and much promise, bred by Mr. F. Bircham, Burhill, Surrey, and got by "Fuchsia." Mr. Cornish's third-prize cow, "Peach Blossom," is very sweet and deer-like, small in size, but nicely shaped, and of fine quality, bred by Mr. F. Le Brocq, and sired by "Wolseley" (2165) E.H.B.

The Class of Two-year-old Heifers was still larger, and contained a number of exceptionally promising young heifers. Mr. George Simpson has much credit by taking the First and Second prizes here with two fine heifers of his own breeding: "Marjorie," got by "Farmer's Joy" (1075), and "Patricia 4th," by the same sire. They are well-grown, well-shaped, robust, yet sufficiently fine in form, and seem likely to turn out deep milkers. Mr. Cornish got the third ticket for "Rozels Fuchsia," a very nicely formed heifer of the choicest character and quality, bred in Jersey by Mr. J. Germain and got by "Brave" (392) J.H.B.

In the Class for Yearling Heifers there were 18 entries, and here again the contest was close and interesting. Mr. Thomas Shaw, M.P., took the first prize into Yorkshire for "Countess," a well-grown, handsome heifer with great promise of udder, but teats just a trifle too close. She was shown in higher condition than some of the others, yet there was hardly any want of elegance or refinement. She was bred by her owner and got by "The Speaker." The second prize went to Mr. S. H. Hyde for "Velvet II.," an exceedingly pretty little heifer of great promise, bred by himself and got by the first-prize bull "Dog Fox." Mr. Cornish's "Golden Primrose" seemed to be unlucky in not getting higher up than third. She is a truly beautiful heifer of the choicest quality and character.

Report of the Judges of Jersey Cattle.

The Classes submitted to us for examination have received our best care. We have based the awards as far as is possible upon the milking qualities, and it is satisfactory to report that in this respect indifferent animals form the exception amongst those competing.

We wish, moreover, to state that it has been an agreeable surprise to find classes so good and so well filled in a locality far removed from the Southern Counties.

In CLASS 107—*Aged Bulls*—14 animals competed. The first prize was awarded to No. 948, a meritorious animal, whose produce should come to the fore in future Show-rings. The second prize was taken by No. 937, a highly characteristic and rich animal, which ran No. 948 very closely for first place. No. 945 took third honours; he has an excellent frame, but lacks to some extent the colour which is taken to denote richness. The reserve was given to No. 951, which was moreover highly commended. This animal has a very good fore-hand, and is likely to improve. The other highly commended animals were 936 good and serviceable, 941 well framed and rich, 947 good points, rather heavy in the head, and 950 well shaped, but not so good a mover as he should be. The commendations were 939 and 943. This Class of *Aged Bulls* was exceptionally good.

CLASS 108. *Bulls calved in* 1886.—The first prize went to No. 972, a nicely grown animal, with good touch. No. 963, with horns a trifle too strong, but otherwise a well-formed animal of good type, came in for second place. No. 970, young and promising, took the third prize. The reserve number, 953, nice looking and rich, but the nipples somewhat uneven, was highly commended. Nos. 957 and 967 were also worthy of high commendation; and Nos. 955, 959, 961, 964, and 965, were commended.

CLASS 109—*Cows, in-milk or in-calf, calved previously to, or in* 1883—brought together some excellent animals. The first prize was awarded to No. 983, in every respect a good cow, fine throughout, rich in quality, and worthy of the position she has attained. Her weak point is an indication of eventual sinking across the loins. The second prize was given to No. 976, finely bred, udder remarkably well set on, and a good type of the breed. Her appearance is somewhat affected by a slight irregularity over the rump. The third place was taken by No. 975, a large and fine animal, horns neat, udder capacious, rather slack forward, but amply made up by unusual size and richness. The reserve number fell to No. 974, which was highly commended for her general appearance and good udder. Her head is rather heavy in the cheek, but her horns are good. The other highly commended animal was No. 980, well framed, but the hind quarters of the udder might be more capacious. The commendations were Nos. 981, 984—a fine useful cow, and No. 985. The whole a good Class.

CLASS 110. *Cows or Heifers, in-milk or in-calf, calved in* 1884.—Here we had in No. 988 probably the best animal in the whole of the female classes. The highly excellent form and development of her udder, with her good lines, at once stamp her as an animal not to be easily beaten in the prize-ring. The second and third prizes were respectively given to Nos. 994 and 991, possessing to a great extent the same points of fine breeding. The reserve number was No. 993, which was highly commended, as was also No. 995. The commendations were Nos. 989, a small dark rich animal, and 997.

CLASS 111. *Heifers calved in* 1885.—The first and second prizes in this Class went to Nos. 1001 and 1002, two animals which balanced one another very equally in merit although in different ways, each possessing excellent dairy points. The third place was given to No. 1007, an animal of fine character, which ran closely in the contest with Nos. 1001 and 1002. No. 1010 was placed as reserve and highly commended, she being a neat little heifer,

and every appearance of richness and milking qualities. Nos. 1006, good heifer, 1011, 1012 large useful animals, were highly commended; and Nos. 1014, 1015, 1017, 1018, were commended.

CLASS 112. *Heifers calved in* 1886.—In this Class the first place was given to No. 1032, a strong heifer, with a very fully-developed udder. She would have shown still better had she been less forced in feeding. The second was awarded to No. 1035, nicely shaped throughout, rich, and promising. No. 1028, a somewhat similar heifer to 1035, with very well-placed teats, took the third place. The reserve went to No. 1029, a pretty dark grey heifer, highly commended, with good appearance, but the hinder teats not so good as they should be. Nos. 1026, 1030, and 1031, were highly commended; and Nos. 1019, 1020, 1022, 1024, and 1034, received commendations.

In concluding this Report we would observe that improvement continues to take place in the general appearance of animals brought for competition. The beefy condition which is so objectionable in animals solely kept for dairy purposes is now the exception. Further, we would remark, in justification of our awards, that though giving the preference to animals showing in their appearance the fineness of the highest Class of Jersey Cow, we have not passed over those showing more size and development than is generally met with in their native island, if they did not exhibit coarseness, and had good dairy qualities; whereas, on the other hand, we have passed by weedy animals deficient in stamina.

CHAS. PH. LE CORNU.
WILLIAM ASHCROFT.

GUERNSEY CATTLE.

This very useful breed of dairy cattle seems likely to gain a strong footing in the United Kingdom. There are already throughout England a number of first-class herds of Guernsey cattle, and every year the ranks of their admirers become greatly increased. Much larger in size, and more robust than the Jersey, they also possess dairy properties of a very high order, while with careful cultivation they might soon attain considerable merit as beef-producers. The writer has seen Guernsey bulls crossed with the ordinary mixed-bred cows of the country with great success, the produce being large handsome cattle, with really good meat-carrying frames and excellent dairy properties. In encouraging the breeding of Guernsey cattle, the Royal Agricultural Society is certainly furthering the interests of British farmers.

At Newcastle the display of Guernsey cattle was not large, numbering 37 entries, and we have seen a finer collection at southern Shows. Amongst the lot, however, there were several excellent representatives of the breed, showing all the good dairy points for which the breed is so highly distinguished.

In the Old Bull Class there were 7 entries, but one did not put in an appearance. The first prize went to Mr. W. A. Glynn, who has long maintained a Guernsey herd of great merit at Seagrove, Isle of Wight, and who led here with "Hopeful," a

low-set, richly-coloured three-year-old bull, of choice quality and desirable dairy character. It was bred by himself, and seems well fitted for getting dairy stock. The second prize went to the Express Dairy Company, Limited, for "Sterling," a much bigger and more lengthy bull of the same age, and also of a useful type, if not quite equal to the other in quality. It was bred by Mr. D. Bichard, Guernsey, and got by the Express Dairy Company's well-known prize bull "Climax" (14) E.G.H.B.

Only four Yearling Bulls were entered, so that the third prize was not awarded. The Hon. Mrs. Arthur Baillie Hamilton came to the front here with "Baron Vauxbelets 2nd," a straight, good-looking little bull, of desirable quality and character, bred in Guernsey by Mr. J. James, and got by "Baron Vauxbelets" (178). The second prize went to Mr. E. P. Fowler for a well-made level bull of nice character, breeder unknown.

The Cow Class was the largest of the breed. It contained several first-class Dairy Cows, and with considerable variety of type, it was by no means easy to satisfactorily award the prizes. The first prize went to Mr. W. A. Glynn for his handsome nine-year-old cow, "Fairy 2nd," deep and long in the carcass, wide behind, fine in front, richly coloured, and with exceptionally good milking features. She was bred by himself, and got by "Honest Tom." The same exhibitor got the third prize for "Fairy 3rd," a very neat, short-legged cow, of similar breeding, and likewise displaying high milking properties. Between these two fine cows was placed a handsome and exceedingly useful three-year-old cow, named "Plaisanterie," owned by the Express Dairy Company, and bred in Guernsey by Mr. W. Burridge.

In a fairly good Class of Two-year-old Heifers, Mr. W. A. Glynn took first with "Honesty 2nd," a big, deep, good-looking heifer, a little more fleshy than most of the others. She was bred by himself, and got by "Bonnie Boy," the sire of the third-prize bull. The Express Dairy Company obtained the second prize and reserve ticket for an excellent pair, the second being "Polly 3rd de la Charneé," a beautifully-formed heifer, of great promise.

The Class of Yearling Heifers was exceptionally good, and the contests were keen. The first prize in this class also went to Mr. Glynn. The Hon. Mrs. A. Baillie Hamilton's second-prize heifer, "Jessie 5th," is very handsome, well-grown, and promising, but just a trifle fleshy in the shoulder. She was bred by her owner, and sired by "First Lord." The third prize and reserve ticket went to The Express Dairy Company.

Report of the Judges of Guernsey Cattle.

We consider that the Show of these cattle, though small in number, was quite an average. No doubt many of the Exhibitors of this breed, residing as they mostly do in the Southern Counties, were deterred from sending their animals so great a distance, and probably the high charges of the Railway Companies had a deterrent effect.

The *Cow* Class was a good one, and, though there may be differences of opinion, we endeavoured to carry out the instructions of the Society in selecting what appeared to us the best adapted for dairy purposes.

The *Yearling Heifer* Class was decidedly good, and shows promise of turning out some excellent cows in the future.

The *Old Bull* Class was deficient in one of the entries. While admiring the style and size of the Bull "Sterling," we considered that "Hopeful" showed more quality and superior dairy points.

The *Young Bulls* were a small and somewhat weak Class, and no third prize was awarded, as only four animals were brought before us. The third prize was also withheld in the Two-year-old Heifer Class for the same reason.

J. Farnaby Lennard.
F. G. S. Nichol.

Kerry Cattle.

For the first time separate classes were provided for these characteristic Irish cattle. So far, the experiment has been successful, for there was an excellent representation of the breed, especially in the class for cows and heifers. The writer confesses to have a liking for the hardy little Kerry. In exposed situations and on thin soil it is unequalled as a dairy cow ; and although small in size, average Kerry cattle fatten readily on good fare and sell well when fattened. They are making their way into England as park cows, and for supplying milk where there are insufficient facilities for keeping larger cows. They are well suited for these purposes, and it is therefore desirable that they should be encouraged in the Royal Show. But it is unsatisfactory to have "Dexters" shown amongst the real Kerries. Although belonging to the same race, the "Dexter" variety is quite distinct, and so decidedly different in appearance and characteristics from the Kerry proper, that the two cannot compete together. On this occasion the judges decided to pass over the "Dexters," and confined their favours to the Kerries. The "Dexters" are thicker in the body, shorter in the leg, and much more fleshy than the Kerry, and in dairying properties the one is nearly as good as the other. It is thus desirable that the "Dexter" as well as the Kerry proper should be recognised by the Royal Agricultural Society.

The first prize in the bull class went to a lengthy, handsome well-grown three-year-old shown by Mr. Hay, from Queen's County, and bred by Mr. Pierce Mahony of Kilmorna. The

Aylesbury Dairy Company got the second prize for "Busaco 3rd," a very nice three-year-old bull, bred by the Dowager Lady Howard de Walden. The reserve ticket also went to the Aylesbury Dairy Company for "Moonlighter", a pretty little calf got by the second prize bull "Busaco 3rd." It attracted much attention at the parades, and amongst its admirers was His Royal Highness the Prince of Wales, who purchased the little Irishman before the close of the Show.

The class of cows and heifers was one of the best of the breed we have ever seen, its high character being indicated by the fact that the first prize cow at the recent great show at Killarney could not get into the list here. It is on this account all the more gratifying to Mr. Martin John Sutton that he should have been able to retain the first prize in England. At Dyson's Wood, Kidmore, near Reading, Mr. Sutton has established a herd of Kerries of the very highest character, and it is worthy of remark that while amongst his few pure Kerries he had one good enough to head a very strong class in the Royal Show, his herd consists chiefly of animals of the "Dexter" type, which would seem to have found most favour with him. His first prize cow "Flora" is a very handsome eight-year-old black, bred by Mr. R. Good, Aherlow, Co. Cork. The second prize went to Mr. James Robertson of La Mancha, Co. Dublin, who has long bred Kerry cattle with distinguished success, and from whose herd Mr. Martin J. Sutton has drawn largely in founding the herd at Dyson's Wood. The Aylesbury Dairy Company obtained the "reserve" ticket for "Lady Waterford," an excellent cow of unknown pedigree.

Report of the Judges of Kerry Cattle.

In reporting on the Kerry and Dexter Class, Nos. 18 and 19, we beg to remark an improvement of the animals brought forward, and bear testimony to a general interest and attention being attracted to this useful class of cattle through the prizes offered by the Society. But we would recommend in future the making two separate Classes, and not mixed Dexters and Kerry, as they are not suitable for crossing, or for the same practical purposes.

GEORGE HEWSON.
LUKE CHRISTY.

DAIRY CATTLE.

In the Class of Dairy Cows four-years-old or upwards, there was as usual a good deal of variety of type and character. The Shorthorn element predominated, and amongst the twenty entries were several big, massive well-shaped cows of a thoroughly useful stamp, as well adapted for beef production as

could be desired, and yet possessing all the visible attributes of deep milkers. The first prize went to Mr. J. Goodrick, Harrogate, for a typical cow of the sort described, bred in Yorkshire, and evidently deep in Shorthorn blood. The same exhibitor got the third prize, for a blue cross-bred, more like a cross between the Shorthorn and Galloway breeds. Mr. James Lowther's second is a deep well-shaped Shorthorn cross, with the appearance of fair milking properties. Several excellent cows were highly commended, including a Kerry shown by Mr. James Robertson of La Mancha, and a Swiss cow exhibited by the Aylesbury Dairy Company.

The Class of three-year-old Dairy Cows was very small, containing only four entries. The first prize here went to Mr. J. J. Sharp of Broughton, for a well-shaped, good looking red Shorthorn cow of his own breeding, got by "Oxford Rose 3rd" (50135), and out of "Julia 13th," by "Cambridge Duke 6th" (33272). Mr. Burnside's second is a straight, useful-looking cross-bred roan, of unknown breeding.

Report of the Judges of Dairy Cattle.

Class 120—*Dairy Cows, in-Milk, of any Breed or Cross.*—This Class was much better filled than has been the case in late years, there being 18 entries, of which 14 came before the Judges. Several breeds were represented, including Shorthorns, Kerries, two Swiss Cows, and various crosses. With two or three exceptions the class was an excellent one.

The Judges were instructed to base their awards upon the relative *apparent* milking properties of the animals exhibited, there being no provision made for testing, accurately, either the quantity or quality of the milk produced. This the Judges much regretted. They would have been better satisfied, and so, most likely, would some of the Exhibitors have been, if the milk had been weighed, and the quality carefully ascertained by Dr. Voelcker, the Society's Consulting Chemist, the same as was done at Preston in 1885, and at Norwich last year. Possibly the Council, before the next Show is held beneath the grand old lime-trees in Wollaton Park, may give to these points the attention they deserve, as quantity of milk produced cannot be reckoned a complete proof of a cow's value for *general* dairy purposes.

The first-prize cow (No. 1116) came well up to the Judges' ideas of what a first-class dairy cow should be; she gave every indication of being a splendid milker, besides having great substance. She was closely followed in the competition by No. 1110, the third prize falling to a blue-grey cross which stood over an enormous udder, but she was somewhat sticky in her coat, and did not show the bloom of her more successful rivals, either of whom might well be taken as a model of a general-purpose dairy-cow. No. 1111 secured the reserve and highly-commended ticket. She was two months calved, and was described by her attendant as being exceedingly good at the pail. Nos. 1113 and 1114 proved to be exhibited by the "Aylesbury Dairy Company," and were described as "Swiss, Silver Grey." Their appearance, so far north, was somewhat novel and peculiar; nevertheless they were evidently good dairy beasts. The better of the pair was highly commended, as was also the pretty little "Kerry," exhibited by Mr. James Robertson, of Malahide, near Dublin.

CLASS 121—*Dairy Cows or Heifers, in-Milk, of any Breed or Cross, calved in* 1884.—With the younger class of dairy cattle the Judges were disappointed, and as only four animals were shown, the third prize was not awarded, the conditions being that no third prize be given unless there are at least six exhibits.

W. P. J. ALLSEBROOK.
THOMAS BOWSTEAD.

SHEEP.

The statement that it was the most complete and best average display of sheep ever seen in any show yard is not likely to be disputed. At any rate it is absolutely true. Several of the individual breeds have made a stronger appearance at former Royal Shows than on this occasion, but never before in one show yard have we seen so many breeds, so well and creditably represented. No fewer than eighteen varieties were comprised in the collection, and at least thirteen or fourteen of these made quite a good appearance. The casual observer may ask the "why and the wherefore" of all this variety in breed and type. Without going the length of saying that all are essential or beneficial, we would affirm that any considerable curtailment of the ranks of the breeds, would certainly result in loss to the sheep farmer. Every one of the dozen or fourteen important breeds possesses some peculiar feature or characteristic, which makes it specially fitted and serviceable for certain localities and customs of farming. Within the narrow limits of the British Isles, there is infinite variety of soil and climate. It is thus desirable and advantageous that in our breeds of live stock there should be considerable variety.

The Royal Agricultural Society has wisely encouraged every variety of farm live stock in any way worthy of encouragement; and it is well known that several important varieties owe their separate existence mainly to the fostering care and stimulus held out in the Royal Show. In sheep as well as in other kinds of live stock, the Society has had ample evidence of the good influence of its work. The best testimony to the benefit it has conferred upon sheep farmers is provided by the fact, that never before in any showyard has such a high standard of excellence been exhibited by so many distinct breeds of sheep as at Newcastle this year.

Upon the whole this year the shearing of sheep would seem to have been well executed. As will be seen from the following, only two pens were disqualified.

Report of the Inspectors of Shearing.

As Inspectors of Shearing we have examined the sheep in the yard, as placed under our inspection, and as a whole we find them well and fairly

shorn; we have, however, found a few doubtful cases, and recommend the disqualification of No. 1213, in Class 134, and also No. 1253, in Class 140.

William Jobson.
J. B. Workman.

Leicesters.

It was quite refreshing to find such a large collection of the patriarchal Leicester, the oldest of all our improved breeds. Forty-three pens were entered, and it is safe to say that in respect to average merit the Leicester was not surpassed by any other variety in the Show. Eight two-shear rams made up a strong class. Mr. T. H. Hutchinson, whose flock of Leicesters has long been unequalled, took the first and third prizes with thick, neatly-formed sheep of his own breeding—shaped as Leicesters ought to be, thick and deep at the heart, broad and well padded with meat along the back, with strong, well set neck, clean, gay-looking head, beautiful skin, fine in the bone, not wide behind, but all over thickly covered with flesh and fat. They were of course brought out in high condition, too fat for general use, yet they carried their mutton well and evenly. Mr. Harrison's second ram is a big, massive-looking sheep with right good carcass, but the skin rather white, and the fleece with a slight tendency to Lincoln character.

The Class of Shearling rams with 20 entries—two absent—was one of the best in the Show. Here both the first and second prizes went to Mr. T. H. Hutchinson for a pair of grand sheep, true in Leicester form and character, thick through the heart, wide in the rib, and all over admirably furnished with mutton, which they carry evenly. Mr. T. Strickland got the third prize and also the "reserve" for a pair of handsome rams, wide in the rib and well covered with mutton, the "reserve" ram being a trifle high on the leg.

Ram lambs in pens of three made up a very good class of 8 entries. Here Mr. T. H. Hutchinson had to give way to a pen of big, well-grown, well-furnished lambs got by a ram of his own breeding—the winner of the second prize at the Yorkshire Show last year. This pen belongs to Mr. W. Walsh of Gilstead, but were bred by Mr. J. B. Green of Low House Farm, Silsden, Leeds. The second prize went to Mr. Hutchinson for a pen of admirably formed lambs, one being slightly unsatisfactory in fleece.

The Class of Shearling Ewes, in pens of five, had 7 entries, one being absent. Both the first and second prizes went to Mr. E. F. Jordan of Eastburn, for handsome ewes of fine style, quality, and character, but some of them not so nice in the heads as could be desired. They were got by a ram of Mr. T. H. Hutchinson's breeding, and should throw excellent stock.

Cotswolds.

This handsome and characteristic breed was well represented in merit, but there was little competition. Of the 15 entries 13 were sent by Mr. Russell Swanwick, of the Royal Agricultural College Farm, Cirencester, whose sheep displayed all the good features of the Cotswold, large size, long broad back, wide rib, clean, hardy-looking head, white, rank curly wool, with good cover of mutton, especially along the back. He was alone in both the Ram Classes, with 3 entries of Two Shears, and 5 of Shearlings, all handsome typical sheep, brought out with good taste and judgment, and all bred at the College Farm.

In the Class of Ram Lambs, Mr. H. Akers, of Black Bourton, Faringdon, appeared with a pen of very high merit, big and hardy-looking, and the first prize was given to them over three excellent pens shown by Mr. Russell Swanwick. In the Class of Shearling Ewes Mr. Russell Swanwick stood first, and Mr. H. Akers second, with sheep of good average merit.

Lincolns.

Lincoln sheep with 28 entries made a creditable appearance. Nevertheless they have on the whole been better at some former Royal Shows. This hardy breed with its admirable fleece is much esteemed in foreign countries, and there was a keen demand here for the prize Lincolns for exportation, chiefly to North and South America.

There were six entries of Two Shear Rams, one absent. The first prize went to Mr. John Pears for an exceptionally good ram of his own breeding; not large in scale, but compact, well balanced, of good character, and very good on the back. Mr. W. T. Sharpe's second ram, bred by himself, is longer in the carcass, and a very good sheep in other points, but is just a trifle slack in the middle.

A very strong Class of Shearling Rams, numbering a dozen entries, was headed by a true type of a Lincoln, shown and bred by Mr. Henry Smith, The Grove, well grown, with good outline, excellent fleece, deep and thick in front and very good under the band. He was sold for exportation to South America. The second prize went to Mr. R. Wright for a very good ram of his own breeding, and one of the second-prize pen of lambs at Norwich last year.

In a small but good Class, Mr. R. Wright took the lead with a pen of well-formed Lambs, of desirable character, standing nicely on their legs, and full of promise. They were got by the same sire as Mr. Wright's prize-shearling rams. The second

prize went to Mr. John Pears for a pen of big, well-grown lambs, scarcely so perfect in form, got by a grandson of Mr. Wright's first-prize two-shear ram at the last Royal Show at York.

There were five entries of Shearling Ewes, in pens of five, but only two appeared. These had a close contest, and amongst the onlookers there was considerable difference of opinion as to the relative claims of the two pens to the leading position. Mr. H. Dudding's first pen of ewes are wide in the rib, and well shaped, but they are scarcely so true to the Lincoln type as Mr. Wright's second pen.

Other Long-woolled Sheep.

In three fairly well-filled Classes, there were nineteen entries of other Long-woolled Sheep, not qualified to compete as Leicesters, Lincolns, or Cotswolds. Nine of these were Wensleydale Long-wools, eight Devon Long-wools, one described as a Cleveland Long-wool, and another as a Masham sheep.

Mr. John Heugh, of Mudd Fields, Bedale, Yorkshire, got the second prize for a pen of lengthy, useful-looking Wensleydale Shearling Ewes. All the other five prizes went to exhibitors of Devon Long-wools. Sir John H. Heathcoat-Amory, Bart., who owns the premier flock of these useful sheep, took the lion's share of the honours. In the Two-shear Ram Class, both prizes went to him for thick, well-shaped, well-furnished sheep. Mr. A. C. Skinner was victorious in the Shearling Ram Class with a very good, well-ribbed sheep.

Sir John Heathcoat-Amory won, in the Class for Shearling Ewes, with a pen of handsome sheep, of good quality, approaching the Leicester type—the only Devon pen in the class.

The Long-woolled breeds of sheep were all judged by one set of Judges, whose report may here be conveniently introduced.

Report of the Judges of Long-Woolled Sheep.

Leicesters, Cotswolds and Lincolns.

Class 122—Two *Shear Rams.*—A good class, 8 entries. Both first and second prize animals were good specimens of the breed.

Class 123—*Shearlings.*—A large and good entry of 20. The first-prize shearling showed all the true characteristics of a pure Leicester, with a good skin and great quality.

Class 124.—A fair class.

Class 125—*Shearling Ewes.*—The class generally good; 7 entries, 5 of which put in an appearance.

Class 126.—A small entry, and one that requires no particular comment.

Class 127.—The same remarks will apply to this Class as to the previous one.

Class 128—*Ram Lambs.*—Four good pens.

Class 129.—Only 2 pens, but both good specimens of the breed.

CLASS 130.—A fair Class, the first prize-animal being a particularly good sheep.

CLASS 131.—A good Class, and here again the first-prize animal was a very good one.

CLASS 132.—Four fair pens of *Ram Lambs.*

CLASS 133.—Out of 5 entries only two arrived, but these were both of good quality.

OTHER LONG-WOOLLED BREEDS.

CLASS 134 contained 2 entries of *Devon Long-wools*, the remainder being Wensleydale. The Devon Long-wools took first and 2nd prizes, and the Wensleydale entries contained some good specimens of that breed.

CLASS 135.—The *Devon Long-wools* were again successful in this class.

CLASS 136 contained 1 pen of *Devon Long-wools* of particularly good quality, and 2 pens of good specimens of the Wensleydale. The Devon Long-wools were deservedly placed first.

GEORGE TURNER.
ROBERT GARNE.
EDWARD J. HOWARD.

OXFORDSHIRE DOWNS.

In merit, if not in numbers, the Oxford Downs were exceptionally well represented. There were twenty-nine entries in the four Classes, and especially in that of Shearling Rams there was remarkably high merit. Only a pair of Two-shear Rams were entered, but both were very good representatives of the breed. Mr. John Treadwell's first-prize ram, "Young Baron Oxford," is a handsome sheep, of good size, and true to Mr. Treadwell's famous type. Mr. Milton Druce's second ram, "Confusion," is a big, good ram, of desirable quality.

In the Class of Shearling Rams there were fourteen rams, and it may be doubted if a better class of the breed has ever been seen in a Royal Show. Mr. John Treadwell, therefore, accomplished a great feat in carrying off the four highest tickets, all with typical rams of his own breeding. Mr. Treadwell has brought out many capital Oxford Down rams, but we are not sure that he has ever shown a better than the first winner here—"Royal Jubilee No. 82," a big, handsome sheep, of grand form, character, and quality. Some would say that his face is on the small side; but there is little there, or in any other part, for which he could be seriously faulted. Like all the others, he was bred by Mr. Treadwell, got by "Royal Preston," and won the Champion Prize over all other breeds at the Reading Show.

Ram Lambs were fairly good. Mr. Milton Druce took the lead with a pen of well-formed, promising lambs; the "reserve" going to an almost equally good pen from the same flock. The second prize went to Mr. G. Adams for a pen of neat, well-shaped lambs in high condition.

The Class of Shearling Ewes was small, but of high merit.

The Countess of Camperdown exhibited her excellent pen of ewes, which took the lead at several earlier Shows; but being in high condition, the fatigue of travelling had told upon them. On this account, they were put back a step; the first place being given to a pen of very good ewes, a trifle light in the leg, shown and bred by Mr. George Adams, and got by "Grand Cote."

Report of the Judges of Oxfordshire Downs.

Class 137. Only two *Sheep* shown in this Class, but well representing the breed, and to which we would recommend a second prize to be given.

Class 138. *Shearling Rams.* This is decidedly the best Class in the breed, and the prize sheep are of more than average merit. We therefore recommend a third prize to be given, although the number of exhibitors is one short of that required by the Society.

Class 139. *Ram Lambs.* We have seen this Class better represented.

Class 140. *Shearling Ewes.* A small Class, but fairly well representative of the breed. The second-prize pen would have held a higher position had they not been overdone in feeding and travelling too much.

Alex. Blake.
James P. Case.

Shropshires.

With the substantial total of 103 entries the Shropshire breed surpassed all others in number. And as to merit, the judges are well justified in saying that the display maintains the reputation of former years. This reputation, be it remembered, is a high one, for the Shropshire classes have for several years back formed one of the strongest features of the Show.

In the Class of Two-shear Rams there were seventeen entries, one being absent. The majority of the rams were of more than average merit, and as there was no outstanding winner, the contest was very keen. Ten tickets of one kind or another were all awarded to animals of good Shropshire form and character. The first prize went to Mr. T. S. Minton, for a very handsome ram, winner of first prize at Dorchester this year, and at Bristol in 1886, bred by himself and got by Mr. Mansell's "Patriotic," a grandson of the famous "Patriot," let one season to serve 100 ewes at 300 guineas. He might be a trifle better in the skin, but he has very few faults and deserved his position. He was hired last season for use in the Duchess of Hamilton's flock. Mr. A. E. Mansell's second-prize ram had not been out before, and is a thick, well-shaped ram, neatly put together, with good skin and beautiful head, bred by his owner and got by "Profit," whose sire was the famous "Patriot" just referred to. The third prize went to Messrs. J. & G. German, for a thick, good sheep, a trifle dark in the skin, which might be stronger in the back, but very good through the heart, and fairly well covered on the head.

The Class of Shearling Rams, numbering 61 entries—12 being absent—was the largest and also one of the best in the show. Mr. Joseph Beach (who realized over 35*l.* each for his Shearling rams this year) deserves much credit for taking both first and second prizes in the face of such strong competition. His first and second-prize rams are thick, plump sheep of true Shropshire form and character, well proportioned, with nice skin and good wool, and of admirable quality. Here again the third prize went to Messrs. J. & G. German, for a good-looking ram with excellent head, not quite so wide in the frame as could be wished, and might be better in the fleece, but on the whole an admirable sire.

No fewer than twelve highly commended tickets were awarded, one going to Mr. James L. Naper, of Loughcrew, who owns the premier flock of Shropshires in Ireland. Ten pens were commended.

Shropshire Lambs do not, as a rule, compare so well as might be expected with those of some other breeds. It would seem desirable that breeders should give a little more attention to their development. The class of ram lambs in pens of three was fairly well filled. Mr. R. Thomas and Messrs. H. & A. Bradburne took the prizes with small but well-formed lambs of considerable promise.

The Class of Shearling Ewes, containing 15 entries, one absent, displayed exceptionally high merit. The judges say truly that seldom has a finer lot of young ewes been exhibited. The first prize went to Mr. J. E. Farmer, for a good-looking pen, showing good quality and character. Mr. P. A. Muntz, M.P., and Mrs. Barrs followed very closely with exceedingly good pens, and it is but right to say that some good judges looking on would have given a higher place, not only to Sir R. Loder's excellent pen which won the "reserve" ticket, but also to Mr. T. S. Minton's highly commended pen, which were first at Reading and some other shows, and which exhibit beautiful heads and fine character, but perhaps want substance slightly. The high character of this class is indicated by the fact that in addition to the five pens already referred to, five other pens of excellent ewes received recognition from the judges. These belonged to the Earl of Strathmore, Messrs. T. & S. Bradburne, Messrs. J. & G. German, Mr. J. L. Naper, and Mr. George Graham.

Report of the Judges of Shropshire Sheep.

Shropshires, upon the whole, maintain the reputation of former years.

Class 141—*Two-shear Rams*—contained 17 entries, possessing true Shropshire form and character, but without an animal of exceptional merit.

Class 142—*Shearling Rams*—contained 60 entries, possessing throughout

true Shropshire character. The prize animals were big sheep with plenty of quality, and beautiful wool, and likely to make valuable sires.

CLASS 143. *Pen of three Ram Lambs.*—These were a promising lot of youngsters, with good heads, and wool of the right sort.

CLASS 144. *Pen of five Shearling Ewes.*—This is an extraordinary Class of 15 entries, remarkable for uniformity of type throughout, with undeniable quality of wool and mutton. Seldom, if ever, have we seen a better lot exhibited.

CHARLES COXON.
C. RANDELL.
P. A. EVANS.

SOUTHDOWN SHEEP.

The Southdown breed was well represented by forty-six entries, with few absentees. As usual, these sheep were distinguished for symmetry, quality and uniformity of type. The weight of carcass which some of the Southdowns carried was indeed wonderful for their fine short legs and general stature. Here, as in other Sections, there were symptoms of excessive feeding, although, taking the show as a whole, there was perhaps less fault to be found on this score than in some former years.

In a very good Class of nine Two-shear Rams, Mr. J. J. Colman, M.P., won rightly enough with an exceptionally handsome sheep of his own breeding, long, level, and well-proportioned, with fine character and quality, and well furnished with wool and mutton. It was bred by himself, and was third as a shearling at Norwich last year. Mr. Hugh Gorringe's second, the first winner at Norwich last year, has scarcely grown so well as could have been wished, and is just a trifle wide in the shoulder; but is thick, compact, well covered with flesh and fat, and of a good type and quality, exceptionally good in the neck. Mr. G. C. Carew-Gibson's third is higher standing, but a good useful sheep of good quality; as is also Mr. Gorringe's "reserve" ram.

The Shearling Ram Class contained twenty-one entries, and the general character of the class was very creditable. Mr. Edwin Ellis could not be denied the first place here for one of the most wonderful sheep in the Show. In the eyes of keen Southdown critics he may seem wanting slightly in refinement, but rarely have we seen a better carcass of mutton on so young a sheep. The depth and width of his carcass are remarkable, and we do not recollect ever to have seen a better leg of mutton on a one-year-old sheep of any breed. He was Champion Ram at the Oxford Show at Banbury, was bred by Mr. Ellis, got by "Merton," and out of a ewe by Mr. Colman's "No. 3," thus combining the strains of the two celebrated flocks of Lord Walsingham and Mr. Colman, M.P. The second prize went to Mr. Colman for a plump, thick, symmetrical sheep of beautiful quality and

character. H.R.H. the Prince of Wales had a very good third in a neat little sheep, with very good neck, nice quality and character.

Eight pens of Ram Lambs were entered, but only four appeared. The first prize went to Mr. Edwin Ellis for a pen of well-formed lambs of considerable promise. The second pen, shown and bred by the Prince of Wales, also exhibited desirable form and character.

The Class of Shearling Ewes, with eight entries, made a creditable appearance. Here, as at Reading, Mr. Colman and Mr. Ellis contested keenly; but the Reading decision was reversed, Mr. Colman being victorious this time. His ewes were handsome, hardy looking, and of excellent quality and character, and they withstood the fatigue of travelling wonderfully well. Mr. Ellis's ewes, on the other hand, lost bloom a little.

Report of the Judges of Southdown Sheep.

Though far away from the home of this breed, a fair number of well-known flocks were represented.

The first-prize *Old Sheep* is a big long sheep of very good form and quality. The second *Sheep* is rather small, but of good type.

The first-prize *Shearling Ram* is a well developed thick sheep, with a good leg of mutton, but just a little lacking in refinement of type.

The *Ram Lambs* are a weak Class.

The first pen of *Shearling Ewes* are strong useful sheep. The second pen were fatted too highly for breeding animals.

John A. Hempson.
Robt. Breton.

Hampshire Downs.

This hardy and very useful breed of sheep has shown great improvement in recent years. It is also extending its hold, and it is worthy of mention that the large majority of the forty-two entries of the breed came from districts outside Hampshire.

The Two-shear Ram Class had eight entries, but two pens were empty. Mr. F. R. Moore, whose Showyard success has lately been quite remarkable, came first with a big good-looking ram, just a trifle slack on the back. Mr. Henry Lambert, whose Champion Hampshires excited great interest at the last Smithfield Show, took the second prize for a well-formed, well-furnished sheep.

Sixteen entries make a strong Class of Shearling Rams. Again the first and second prizes go respectively to Mr. F. R. Moore and Mr. H. Lambert. The first-prize ram is straight, handsome, and true to the best Hampshire form and character. The second is a trifle light in the fore-rib, but is exceptionally good

on the loins. Mr. H. Perry-Keene got the third prize with a good useful ram.

The breeders of Hampshires have been wonderfully successful in developing lambs, and here, as usual, the Class of Ram Lambs is one of the best in the Section. Mr. Moore once again took the lead. His first-prize ram lambs show great size and substance for their age, and they are also true in form and exceedingly well matured. Mr. Lambert followed closely with a pen of thick, well-furnished lambs, rather shorter in the frame.

There were only three pens of Shearling Ewes, but Mr. Perry-Keene had a very grand pen for the first prize. They are big, handsome, well-proportioned sheep, admirably furnished with mutton in the best parts. They have won at several Shows this year. The second prize went to a fairly good pen from the College of Agriculture at Downton.

Suffolks.

The Suffolk breed makes an important addition to the list of recognised English breeds of sheep. They possess properties which are sure to gain a good name for them as rent-payers, and it may be expected that, under the fostering care of the Suffolk Flock Book Society, and with the stimulus derived from separate classes in the Royal Show, the breed will make rapid strides in improvement, as well as in public favour. Considering that this is only the second year in which separate classes have been provided for the breed, and that the distance from the home of the breed to Newcastle is so great, the collection, numbering twenty-two entries, must be regarded as very credittable. The sheep displayed undoubted merit, and when the breeders have had time to cultivate uniformity of type, as well as perhaps a little more refinement, they will make a good appearance amongst the best of the English breeds. Some of them approach pretty nearly to the Hampshire type, but are scarcely so wide in the frame. They are very hardy and useful-looking, with their dark faces and well-set legs, but their appearance would be considerably improved by cleaner and smarter-looking heads and faces.

In a small Class of Two-shear Rams the Marquess of Bristol got the first prize for a straight good-looking sheep, with handsome outline, but wanting a little in width. He was first in the Shearling Class at Norwich. The second prize went to Mr. Robins for a sheep of a different type, somewhat leggy, but well furnished with mutton. Amongst Shearling Rams, the first prize went to Mr. Joseph Smith for "Norwich" (176), a big handsome sheep of his own breeding; not quite so well furnished

with mutton as could be desired. The second prize went to the Marquess of Bristol, for a very good hardy-looking ram of the same breeding as the first-prize two-shear ram.

The Class of Ram Lambs was well filled. Here the Marquess of Bristol came first with a pen of handsome well-grown lambs, got by his first prize two-shear, and second prize shearling ram. The second prize was awarded to Mr. Robins, for a pen of good-looking, but rather high-standing lambs, similar in type to his second-prize two-shear ram.

Again amongst Shearling Ewes, which were few in number, but of fair merit, the Marquess of Bristol took leading honours. His sheep were brought out with good taste, and in excellent breeding condition. His first-prize ewes were large and well shaped, but rather long in the legs. Mr. Joseph Smith obtained second honours with a pen of hardy useful-looking ewes.

Report of the Judges of Hampshire and Suffolk Sheep.

The *Hampshires* were a fairly good Class, but, owing to the great distance from their locality, the entries were rather small. The *Ram Lambs* were quite up to the average, and the winning pens were very matching.

The *Suffolks*, taking into consideration the short time this Class has been recognised by this Society, and also the distance, make a very creditable show, and in the future will no doubt hold their own with other Classes.

We are of opinion that both excessive feeding and colouring are detrimental to the interests of all exhibitors.

S. W. TAYLOR.
SAM. W. SLATER.

BORDER LEICESTERS.

The display of these handsome sheep was disappointing. It has often been better at local Shows in the Border districts. So near to the home of the breed, a larger and much superior collection was expected at Newcastle. About half-a-dozen of these pens were very good; the others, as a whole, were unsatisfactory.

In the Class for Adult Rams, Two-shear and upwards, the Right Hon. A. J. Balfour, M.P., of Whittinghame, got the first prize for a sheep of his own breeding, very good on the back, but wanting in depth. The Class of Shearling Rams contained several very good sheep; Mr. Thomas Clark's first being a wide-ribbed, thick, handsome sheep, very thick through the heart, admirably furnished on the back, and tolerably deep in carcass. Mr. Balfour's second is a big, wide sheep of desirable character. Mr. A. R. Melvin's third is a well-furnished, good-looking ram of fair depth. Mr. Clark's reserve ram, and Mr. Jack's highly commended ram, also displayed considerable

merit. Fairly good pens of Shearling Ewes, showing desirable type and quality, were exhibited by Mr. Balfour, Mr. T. Clark, and Mr. Melvin.

Report of the Judges of Border Leicester Sheep.

We are very much disappointed in the exhibits.

Class 157.—The first-prize *Sheep* was very neat, but deficient in size. The remainder were of an inferior class.

Class 158.—With the exception of the prize numbers, this Class was a very inferior one, and not what one would expect for the Royal when held in their native counties.

Class 159.—A very poor Class.

Class 160.—A fair good show; first and second very good.

George Torrance.
James Chrisp.

Cheviots.

A better display of Cheviot sheep has seldom been seen in any Showyard. There were forty-six entries of the breed, and it is remarkable that, with the exception of one third, all the prizes should have been won by two brothers, Mr. John Robson, Newton, Bellingham, and Mr. Jacob Robson, Byrness, Otterburn, both in Northumberland. The flocks possessed by these gentlemen are of old and pure descent, and one could not desire truer representatives of the hardy Cheviot than were exhibited by them at Newcastle. Mr. John Robson had the best of the contest, his sheep being rather larger in size and in higher condition than those shown by Mr. Jacob Robson; but in regard to quality, character, and hardiness, there was little advantage on either side.

In an excellent Class of Two-shear Rams, with fifteen entries, Mr. John Robson took first, second, and fourth positions with very excellent sheep; the first winner being a deep and square handsome sheep of desirable quality. Mr. Jacob Robson came third with a neat ram of smaller size, but excellent quality.

Amongst Shearling Rams, the three prizes, as well as the "reserve" ticket, went to Mr. John Robson; his first-prize ram being one of the finest sheep in the Show, remarkably deep and thick in the carcass, with good quality, character, and cover of wool. Two or three rams, slightly smaller in size, shown in this Class by Mr. Jacob Robson, were greatly admired for their type and symmetry.

Mr. John Robson's first-prize pen of Aged Ewes are well-shaped and very hardy-looking. They were pressed closely by an excellent pen shown by Mr. Jacob Robson. Again amongst Shearling Ewes the Messrs. Robson competed keenly with sheep of high merit. Mr. R. W. Laidlay, of Halls,

Dunbar, got the third prize for a pen of neat, hardy ewes of good quality. Mr. D. Hall's reserve ewes are also of a high character.

Report of the Judges of Cheviot Sheep.

The *Cheviot* breed of Sheep were largely represented, and the competition was very keen in all the Classes.

The *Two-year Ram* Class contained no less than 15 entries. The prize winners, in that Class, were of superior quality.

The *One-year-old* Class also require special notice. The first-prize *Sheep*, for style, quality, and fineness of wool, can seldom be surpassed in any Show-yard of the Cheviot Class.

The *Ewe and Gimmers* Class were also of very fine quality, and reflected great credit upon those to whom they belonged.

JOHN CLAY.
THOMAS ELLIOT.

BLACK-FACED SHEEP.

This hardy mountain breed, which has been much improved in recent years, was fairly well represented. A few of the prize sheep were of high merit, but some of the classes were weak, and often at leading Scotch Shows the breed makes a stronger appearance. There were in all thirty-three entries.

A dozen entries made up a strong Class of Adult Rams, Two-shear and upwards. The first prize went to Mr. John Archibald, of Overshiels, for a thick, wide two-shear ram of his own breeding, well covered with mutton all over, carrying a good fleece and good typical head, but not desirable in the colour of the face. Mr. W. McCracken's second-prize ram, "Young Laird," bred by himself, and got by "Laird," is a year older, and his wool is losing quality, but he is a thick well-formed sheep of a hardy character.

In the Class of Shearling Rams, with fifteen entries and a few empty pens, there was again an interesting contest between Mr. Archibald and Mr. McCracken. The latter turned the tables here, taking the lead with a deep, well-shaped ram of great merit, bred by himself, and got by the second-prize old ram. He is well-grown, is of excellent quality and character, and has a good head and admirable face and jaw. He was purchased by Mr. Charles Howatson, of Glenbuck, who had entered some pens, but did not send the animals. Mr. McCracken also got the third, fourth, and fifth places with other three good rams of a useful type. Mr. Archibald's second-prize ram of his own breeding is not big, but shows excellent quality and character.

The Ewe Classes were small, but Mr. Rawlinson's two first-prize pens showed considerable merit. They are not large in size, but hardy and useful-looking.

Report of the Judges of Black-faced Sheep.

Class 165.—The first-prize *Ram* has a well-formed body, handling true all over, and has a good coat of wool. The colours of the face are a little mixed, and are lighter than those which have been fashionable for some years; he has a good face and well-formed head. The second-prize *Sheep* is older, his coat has begun to fail, and he thus wants the bloom of his opponent, but he is a very useful sheep.

Class 166.—The first-prize *Sheep* in this Class is one of very high merit; he is far in advance of all his opponents, in fact, few like him are to be seen, so good round the heart and true in shape, with a grand coat of wool.

Class 167 contained one pen of good *Ewes*.

Class 168.—The first-prize pen were excellent sheep, well worthy of being exhibited.

Robert Paterson.
John Irving.

Herdwicks and Lonks.

There were twenty-three entries of Herdwick Sheep, and, as a whole, the display was of a creditable character. Mr. George Browne's first-prize three-shear ram is a big, massive sheep, carrying a great fleece, which had not been shorn this year. Mr. James Spencer, the representatives of the late Mr. H. Parker Holme, and Mr. H. C. Howard also showed some excellent sheep of the same kind, dividing the honours amongst them.

The Lonk Sheep, of which there were nine entries in three classes, as usual attracted a good deal of attention. They were shown in the fleece, and a marvellous fleece it is! Both the first prizes in the Ram Classes went to Messrs. Mitchell Dearden and Joseph Blackburn for sheep of great size. Mr. W. Walsh headed the Ewe Class with a pen of good-looking sheep.

Report of the Judges of Herdwick and Lonk Sheep.

We found a very good entry of Herdwicks, seeing that the Show is held a considerable distance from the Hills where this class of sheep is located.

Class 169.—The competition in the *Aged Sheep* Class was very keen, and the entry much above that of previous Shows. The Class also was good; and if the two first-placed sheep had been both shorn, we should, we think, have been better able to decide.

Class 170.—In this Class also we had a good entry, and again had to decide between shorn and unshorn sheep. However, the sheep we placed first and second were both unshorn, and we had little difficulty in making our award.

Class 171.—In this Class the entry was shorter, but the Class was fair, especially the first and second prize sheep.

Class 172.—In this Class also the entry was small, and here also we had again Ewes both shorn and unshorn, and we had a difficult task to make this award.

Class 173.—There were only 3 entries in this Class. They were also unshorn, save where the shepherd has tried his hand to level his exhibit; but

we do not think that the levellings done improved the animal. All three were good sheep.

CLASS 174.—This Class was just the same in number as the *Aged Class*, and all were good sheep of their kind.

CLASS 175.—Three pens of *Gimmers* competed here. All were good; and we had some difficulty in placing the first and second.

A word or two as to the option of Exhibitors—whether they show their sheep in or out of their wool. We are strongly of opinion that the same rule as to shearing should be enforced with regard to mountain sheep as the inland sheep. It is almost impossible for any Judges to satisfy themselves when sheep come before them as they did in the Classes which we judged.

JOHN HOGARTH.
JOHN INGLEBY.
JOHN RICHARDSON.

OTHER SHORT-WOOLLED BREEDS.

Under this designation there were a few interesting pens: five good pens of Ryeland sheep, exhibited by Mr. Frank Shepherd, The Brook, Colwall, Malvern; one pen of good Dorset Horned Ewes, shown by Mr. Samuel Kidner, of Bickley Farm, Milverton, Somerset; and a pen of Shetland Ewes, black, small, and unshapely, exhibited by Mr. T. L. Watson, of Leaburn, Hawick.

PIGS.

As in the cases of beef and mutton, there has in recent years been a change in the taste of consumers of ham and bacon. Fat pork is disliked; lean is more extensively in demand than ever before. Lard has fallen greatly in value; the lean flesh of the pig brings a higher price than any other kind of butcher's meat. It thus becomes evident that to suit the wants of the altered times, a pig of a different pattern from that cultivated formerly is now desired. The model pig of to-day is one that will in the shortest time and at the least cost produce the maximum amount of lean meat in the best parts, with the minimum of low-priced or discounted meat and valueless offal. To ensure this, the pig should be long in the body, deep in the ribs, still deeper in the ham, level in the back, broadening backwards, so that the hind-quarters may be deep, broad, and square, and full in every line, whether from the rear, side, or top view; and the fore-parts, where the low-priced meat is formed, should be thinner and lighter, with clean jowl. The bone should be fine, with nowhere any appearance of coarseness. One great desideratum is a large proportion of lean meat, and as a plentiful covering of hair is taken as indicative of this, considerable importance is attached to the coat.

Going through the great collection of pigs at Newcastle with an animal of the kind indicated impressed on the mind, one

could not be quite satisfied with what one saw. Cursorily inspected, the collection looked really well. It was very large; all the important varieties were strongly represented; and there was undoubtedly considerable merit in most of the classes. Still one could have wished to have found a nearer and more general approach to the attributes of the model pig which bacon-curers now look for. The Judges were no doubt in the main guided in making their selections by these points of practical utility; yet too often amongst the prize-winners were found pigs with ample development in front, but with hind-quarters deficient either in length, depth, or thickness, or in all three. As a rule, there was sufficient width of rib, and in the majority of cases also almost as much depth as is desirable. The most frequent and most important fault was a deficiency, as has been indicated, in the hind-quarters, generally accompanied with greater development in front than there is any need for. In the breeding of pigs as much skill and success have been manifested as in the breeding of other varieties of farm live-stock, and provided that Judges at our leading Shows are careful to watch the changing taste of the times, and to give the places of honour to the pigs which, from a practical and utilitarian point of view, are best suited to provide the wants of the day, we may rest assured that the breeders of pigs, who have in the past attained so much success, will not be slow in their efforts to mould their stock and modify their practice so as to please the consumer.

Large White Pigs.

With an entry of fifty-three pens, a few of which were empty, the Large White variety was very well represented. The sows especially were of high merit; and it was noticed that all through the Show there was more merit among sows than boars, good as a few of the latter were.

The Earl of Ellesmere, who showed a lot of excellent pigs, won all the tickets for Boars farrowed in 1886 with four very good-looking pigs. The first, "Worsley General 6th," is very good along the back, but he might be better in the hams, and he was rather bare of hair. The second pig, "Worsley General 8th," though not quite so good in some other points, is rather longer in the hind-quarters.

In the Class for Pens of Three Boars farrowed in 1887, Mr. F. A. Walker-Jones took the lead with big, well-developed, well-formed pigs, somewhat deficient in lean meat. The next three tickets went to the Earl of Ellesmere for good promising youngsters.

Sows farrowed previously to or in the year 1886 made up a very strong Class. Mrs. Meynell-Ingram's grand sow, "Lady Shrewsbury," a former winner, was rightly enough placed first, although she was followed by some sows of very high merit, shown by Mr. Walker-Jones, Mr. P. Ascroft, Mr. James Howard, and Mr. Sanders Spencer. The second is a very good pig, but wants depth a little; the third is a trifle narrow, but well fleshed.

The Earl of Ellesmere won the first and second prize in a very strong Class of Pens of three Sows farrowed in 1887, with pens of well-formed pigs of a fairly good type. The first-prize pigs are thick enough, and well grown, but want depth slightly. The third-prize pigs shown by Mr. Walker-Jones are bigger, and of a very useful kind.

Middle White Pigs.

There was a smaller display of this variety, numbering thirty-four entries, but again there was considerable merit in all the classes.

Mr. T. Collinson headed the single Boar Class with "Silver King," a very well-formed pig, exceptionally good behind, well haired, and of nice quality, but rather heavy in front. Messrs. Carter and Sons got the second prize for a thick well-fleshed pig, wanting a little in the ham, and also rather heavy in front. For pens of three Boars farrowed in 1887, the Earl of Ellesmere took the lead with a pen of first-class pigs, thick, good in the ham, and well brought out.

There was an excellent Class of Sows farrowed in or before 1886. Mr. P. Ascroft won here with "Lucy," a thick, handsome, well-haired sow, carrying a great deal of lean meat. She was first at the Bath and West of England Show at Dorchester, and was bred by Mr. G. Lewis, of Ercall Park, Wellington, Salop. The Earl of Ellesmere's second-prize sow, "Worsley Princess 4th," is a very good pig in several points, but is somewhat drooping in the hind-quarters. Messrs. Carter and Sons got the first prize for pens of three Sows farrowed in 1887, with fairly good pigs of a desirable type, except that they might be better in the ham. The Earl of Ellesmere's second-prize pigs are thick, well-shaped, and well-grown, but wanting in appearance of lean meat.

Small White Pigs.

A small muster of these, numbering twenty-four entries, presented considerable variety of type and merit. Boars far-

rowed in 1886 were few in number, and not of a high character. The Class of pens of three Boars farrowed in 1887 was still smaller, but the Earl of Radnor's first-prize pigs are exceptionally good, true to type, and better in the hind-quarters than most pigs of the small breeds.

The Classes of Sows were much stronger. The Earl of Ellesmere's first-prize sow, "Worsley Beauty," is a good-looking two-year old, with nice head, but a trifle light behind. The second prize went to Mr. Walker-Jones for a thick well-fleshed sow, rather short in the frame. The Earl of Radnor's third sow is very thick, deep and full in the ham, and if she had been a little larger in scale would most likely have been placed at the head of the class. Mr. Sanders Spencer's "Holywell Silky Locks," which was first at Norfolk, was not placed here. She is a well-grown pig, well haired, and good in the hind-quarters. The Earl of Radnor's first-prize young sows are thick well-shaped pigs, admirably developed in the important parts. The second pen, shown by Mr. Walker-Jones, also displayed good shapes and nice quality.

Report of the Judges of White Pigs.

CLASS 179. *Large Breed Boars, farrowed in* 1886.—We are glad to report the animals in this Class a better representation of the true type than what we have seen during late years.

CLASS 180. *Pen of Three Large Breed Boars, farrowed in* 1887.—A promising lot of young stock amongst the prize winners, the remainder of the Class denoted too much of the Middle Breed.

CLASS 181. *Sows of the Large White Breed.*—This Class was the largest and best we have had before us for many years, the competition being very close.

CLASS 182. *Pen of Three Large Breeding Sow Pigs of the same Litter, farrowed in* 1887.—A large, good Class, some of the pens so large that we were surprised to find them so well developed at the age represented.

CLASS 183. *Middle White Breed, Boars.*—After the prize winners, the remainder of the Class were not true to type.

CLASS 184. *Middle White Boars, Pen of Three, farrowed in* 1887.—The first and second prize pens were fairly good; the remainder showed too much of the large breed.

CLASS 185. *Sows of Middle White Breed, farrowed previous to or in* 1886.—This was an excellent Class, all the sows showing merit. The competition was very strong and close, and took considerable time in making the awards.

CLASS 186. *Pen of Three Middle White Breeding Sow Pigs of the same Litter.*—The prize winners were fairly good, the remainder showing too much of the large or small breed.

CLASS 187. *Small White Boar, farrowed in* 1886.—An ordinary Class.

CLASS 188. *Small White Boars, Pen of Three, farrowed in* 1887.—Quality fair. No competition.

CLASS 189. *Small White Breeding Sow, farrowed in or previous to* 1886.—Competition in this Class was great, but many of them showed too much of the middle type. The prize winners represented the Class well.

CLASS 190. *Pen of Three Small White Breeding Sow Pigs, farrowed in* 1887.—A small Class, and nothing particular.

JOHN ANGUS.
PETER EDEN.
R. H. WATSON.

BERKSHIRE PIGS.

The display of Berkshires, numbering 37 entries, was very good as a whole. The first-prize Old Boar, shown by the representatives of the late Mr. A. Stewart, is a long, handsome pig of good quality, but wanting a little in depth. Mr. T. S. Minton's second shows beautiful quality, but is rather small. Mr. A. S. Gibson's "reserve," a former winner, is a very good stamp of a pig, and if he had been in better condition he might have stood higher in the list. Mr. Benjafield's first-prize Young Boars are of a good type and considerable promise. Mr. Darby's second pigs are also handsome and of nice quality, but not quite so good behind as could be desired.

The Adult Sows made an excellent class. Mr. Benjafield's first-prize sow is a big, long, thick pig with good quarters, especially well developed on the loins, but wanting a little in the fore rib. Mr. King's second is a lengthy nice pig of desirable quality, winner of first and special prizes at the Royal Counties and Oxford Shows. Mr. Darby's third is a good-looking sow of a very useful type, not quite so high in condition as some of the others.

OTHER BLACK PIGS.

In these classes the large majority of the 20 entries were of the Suffolk breed, of which some excellent pigs were shown. Mr. George Pettit's first-prize boar is a well-formed lean pig; the Duke of Hamilton's second being a nice thick pig of good quality. Mr. J. A. Smith's "reserve" pig is true to type and of the choicest quality. Mr. Pettit won in Pens of Three Boars farrowed in 1887, with exceptionally handsome and promising youngsters, the Duke of Hamilton and Mr. J. A. Smith contesting keenly for the second place.

The Duke of Hamilton's first-prize sow is well formed, but rather soft in flesh. Mr. Pettit's third is small but of fine quality, and Mr. J. A. Smith's "reserve" sow is exceptionally promising, but very young. The young sows were very good as a lot, but the pens were not of uniform merit.

TAMWORTH PIGS.

There was an exceptionally large display of this useful and rising breed, which is distinguished for the production of lean

meat. There was keen competition amongst pigs of great size and usefulness, shown by the Aylesbury Dairy Company, Messrs. J. & J. Norman, Mr. W. H. Mitchell, and Mr. R. N. Sutton-Nelthorpe. The Judges remark upon a variety of colour and form which breeders should endeavour to remove.

Report of the Judges of Coloured Pigs.

CLASS 191.—The first-prize *Boar* was extremely good, and had great length and good quality. The second had fine quality, but was rather short, and the reserve was somewhat out of condition.

CLASS 192.—It seems to us that it would be better to have only two young boars shown in this Class instead of three. There seems to be at least one inferior boar in each lot, which would not improve the breed, and if purchased because of a prize lot, might deceive a breeder. We withhold the third prize on this ground.

CLASS 193.—A grand Class. Two types of animals were exhibited, one showing superior form and quality, and the other perhaps greater size, but coarse.

CLASS 194.—The same observation applies as to Class 192.

CLASS 195.—Nothing very special. Only one good in this Class.

CLASSES 196 and 198.—Same observation applies as to Class 192.

CLASS 199.—The Tamworth Pigs showed in greater numbers than formerly, and if they are to come into favour with breeders, one colour should be recognised as the correct type. The colours differed a good deal, as also did the quality of hair and depth of sides.

R. HARVEY MASON.
MATTHEW SAVIDGE.

CHEESE.

There were in all 47 entries of Cheese—7 of Cheddar, 7 of Cheshire, 10 of Stilton, 2 of Wensleydale, 10 of other British make, and 11 of English Soft cheeses. The Cheddar cheeses as a whole were of a high class. The other varieties were more uneven in merit.

Report of the Judges of Cheese.

We have much pleasure in stating that the *Cheddar* Cheeses were excellent, having retained condition and flavour, and will still keep a greater length of time if required to do so.

Cheshire.—We found this a very good Class, but not as a whole equal to the Cheddar Cheeses in their keeping qualities.

Stilton.—We were not at all satisfied with this Class, the prize lots only being of fine quality.

Wensleydale.—These Cheeses were over-kept, and had lost their flavour.

Any other British Make.—A few of these lots were excellent, but as a whole improvements are needed.

English Soft Cheese.—In this new but important branch of dairy farming we advise careful study with a view to improve the quality.

GEORGE LEWIS.
GEORGE GIBBONS.

BUTTER.

It was satisfactory to find such a large display of butter—107 entries. The two classes of fresh butter, one absolutely free from salt, and the other slightly salted, contained respectively thirty-eight and forty-three entries, and in these the average standard of quality was fairly creditable. The prize-samples were very good indeed. The Judges, it will be seen, were not favourably impressed by the salted butter.

Report of the Judges of Butter.

We have much pleasure in stating that both of the Classes for "Fresh" Butter are, on the whole, very good; but the "Salt" Butter is a most inferior Class.

G. M. ALLENDER.
JOHN CARRICK.

BEES.

Bee-culture in all its phases was well illustrated at Newcastle. Thanks, in a large measure, to the British Bee-keepers Association, this interesting and useful industry is now in most parts being conducted upon far more humane and intelligible principles, and also much more profitably, as well as more pleasantly, than in former times. In this department of the Show there were no fewer than seventeen classes, with a total of 191 entries. Lectures on Bee-keeping, with practical illustrations as to the handling and general treatment of bees, were given daily by Mr. S. J. Baldwin, who represented the British Bee-keepers Association. Large audiences looked on and listened with much interest.

POULTRY.

This was the third year of a Poultry Show at the Royal, and it was evident that both amongst Exhibitors and the Public this department has gained in popularity: the former by making larger entries, and the latter by crowding the sheds from the opening of the doors after the Judges' awards. The Show was interesting from the fact of only one hen being shown in a pen instead of three as heretofore; and this we believe was appreciated by the exhibitors. A still further improvement might be made by showing a cock and hen in every class, the Game Classes perhaps excepted.

In many of the Classes there were good entries; some, however, were very weak, notably Cochins, Scotch Greys, and Game. There was only a small show of Aylesbury Ducks, and a large

one of Rouen, the North of England being probably more favourable to the latter than the former.

A moderate display was made by the Geese and Turkeys. The young Turkeys looked most dejected, and are not fit to show at the season when the Show is held. It will be a question for the Society whether this Class should not be omitted in their future Shows.

The collection of Poultry was larger than in any of the preceding years, and as to its very high character there is the best possible testimony in the Official Report by the Judges, which is here appended.

Report of the Poultry Judges.

We desire to congratulate the Council of the Royal Agricultural Society on the great improvement in the Poultry Classes at the present Show over those at the previous Exhibitions held at Preston and Norwich; and also on the general excellence of the birds exhibited, considering the month in which the Show is held. Taking the Show as a whole it is very satisfactory, and by its educational influence cannot fail to serve the object which the Society has in view. We desire, also, to speak of the excellence of the arrangements, and in this context have only to suggest that an alteration be made in the drinking fountains, which are unsuitable for heavy-combed and crested fowls.

A. G. Brooke.
Edward Brown.
H. Heaton.

XXV.—*Report on the Farm-Prize Competition in Northumberland and Durham in* 1887; *Classes* 1, 2, 3. By William C. Little, Stags Holt, March.

Judges.

A. Peterkin Hope, Sunwick, Berwick.
E. F. Jordan, East Burn, Driffield.
William C. Little, Stags Holt, March.

Ever since the Oxford Meeting of the Royal Agricultural Society of England in 1870, when the first competition among farmers for a prize for the best-managed farm took place, there has been a similar competition in the district of the Society's annual Show.

The several classes for which prizes were offered by the Local Committee in connection with this year's Show at Newcastle were as follows:—

Class 1.—For the best managed arable and grass farm exceeding 300 acres, 50*l.*; second best, 25*l.*

Class 2.—For the best managed arable and grass farm of 100 acres and not exceeding 300 acres, 50*l.*; second best, 25*l.*

CLASS 3.—For the best managed combined hill or moor and arable farm, of which not less than 100 acres shall be arable and not less than 400 acres hill or moor, 50*l.*; second best, 25*l.*

CLASS 4.—For the best managed dairy farm of 75 acres and upwards, where the management and cultivation are most successfully directed to the production of milk, butter, or cheese, 50*l.*; second best, 25*l.*

CLASS 5.—For the best managed arable and grass farm of 100 acres and upwards, occupied and carried on in conjunction with a colliery, 50*l.*; second best, 25*l.*

CHAMPION PRIZE of 100*l.* offered by the NEWCASTLE FARMERS' CLUB.—For the best managed farm in Classes 1, 2, 3, and 4, in addition to the prizes in those classes.

The competition, except in Class 5, was limited to tenant-farmers in the counties of Northumberland and Durham paying a *bonâ fide* rent for at least three-fourths of the land in their occupation.

In making their awards, the Judges were instructed especially to consider:—

1. General management with a view to profit.
2. Productiveness of crops.
3. Quality and suitability of live-stock.
4. Management of grass-land.
5. State of gates, fences, roads, and general neatness.
6. Mode of book-keeping followed (if any).
7. Management of the dairy and dairy produce, if dairying is pursued.

Two sets of Judges were appointed by the Society—one of them taking Classes 1, 2, and 3, the other, Classes 4 and 5. The Champion Prize was awarded by the whole number of Farm-prize Judges.

The first visit of inspection by the Judges in Classes 1, 2, and 3 was made between the 13th and 22nd of December, 1886, when sixteen farms in these classes were inspected. The weather during the greater part of the time was very unfavourable. During the first two days there were storms of rain and snow, then came three comparatively fine days of hard frost, during which the hill farms were seen. Afterwards the ground was covered with several inches of snow, and the last day was a miserably cold thaw, with pouring rain. Under these circumstances it was impossible in many cases to see the land; all that could be done was to look at the stock, the roots, and the buildings, and to endeavour to gain some idea of the system of management adopted by the several competitors.

The second inspection of the hill farms was made on the 10th, 11th, and 12th of May. On this occasion the present writer was prevented by serious illness from taking any part, and he had to rely on the assistance of his colleagues, who kindly undertook to make notes of what they saw for his information. The second inspection of the thirteen farms in

Classes 1 and 2 was made in rather unfavourable weather, between May 23rd and June 1st. On this occasion all the farms were closely inspected.

The final inspection was made between the 1st and 7th of July. On this occasion all the farms in Classes 1 and 3 and three farms in Class 2 were inspected. The weather was most favourable for the Judges' work, though too hot and dry for some of the competing farms.

After the Judges of Classes 1, 2, and 3 had come to a decision as to their awards, they met the Judges of Class 4, for the purpose of awarding the Champion Prize. Each set of Judges selected one farm as the best of those under their inspection, they then viewed the farm which they had not previously inspected, and afterwards in the general meeting the merits of the two selected farms were discussed, and a decision arrived at.

It has been the usual practice of reporting Judges to present a sketch more or less elaborate of the farming of the counties in which the competing farms lie. As the writer of this Report made his first tour in Northumberland and Durham in December last, as his opportunities of observation were almost entirely confined to those districts in which the competing farms lay, and as some of the best-farmed districts of Northumberland were entirely unrepresented in the competition, it must be understood that in the following account of the farming in Northumberland and Durham he has drawn largely upon other sources of information than his own personal observation.

Northumberland.

This, the northernmost county of England, has for its boundaries the German Ocean on the east, Scotland and Cumberland on the west, and Durham on the south.

It contains 1,290,312 acres, or more than 2000 square miles. In respect of area it ranks fifth among English counties, but so large a portion of it is hill and moor that in respect of cultivated area * its position is twelfth.

Population.—Taking the county as a whole, it is rather thinly populated, as will be seen by the following figures :—

	Northumberland.	Durham.	England.
Population in 1881	434,024	867,586	24,608,391
Number of persons per square acre	·34	1·34	·75

* *Cultivated area* is used to describe land included in the Agricultural Returns as under all kinds of crops, bare fallow or grass.

It will be seen that England generally has a population twice as dense, and Durham one four times as dense, as that of Northumberland. But if the details of the Census Returns be examined, it will be found that more than 60 per cent. of the whole population of the county is congregated in the neighbourhood of Newcastle. The Newcastle and Tynemouth Registration Districts, which include only about 46,000 acres, or less than 4 per cent. of the whole area of the county, have a population of 264,427 persons, or nearly 61 per cent. of the total population. In the North and West, as in the Bellingham and Rothbury Registration Districts, the population was extremely small, ranging from 16 to 25 per square mile.

The total number of persons classed in the Census Returns as engaged in agriculture was, in 1881, 15,198 males and 3703 females, or 18,901 in all. In addition to these, 2593 persons were classed as engaged about animals.* The total agricultural class (not including children) comprised 21,494 persons. It appears from these figures that the whole agricultural class was barely 5 per cent. of the population, while those directly engaged in agriculture were only 4·3 per cent. of the whole population of the county.

The following Table exhibits some curious facts as to the relative numbers directly engaged in agriculture in the two counties of Northumberland and Durham :—

	Northumberland.	Durham.
Total number of persons engaged in agriculture	18,901	14,574
Number per 100 acres of total area	1·47	2·25
Number per 100 acres of cultivated area . .	2·38	3·43

It is worthy of notice that the total number enumerated in 1881 as agricultural labourers in Northumberland was 8349 males and 3361 females, or 11,710 persons, besides which there were 1274 shepherds, and 363 farm bailiffs. These three classes thus included 12,073 persons, a number far exceeded by that of the miners in the same county, who were 21,567.

Industries.—The trade and commerce of the county, which are chiefly concentrated in the populous region in the neighbourhood of Newcastle, are extensive and varied. Coal mines,

* This class includes grooms, veterinary surgeons, cattle salesmen, drovers, gamekeepers, &c., &c.

lead mines, and those of other minerals, engineering and ordnance works, manufactories of chemicals, glass, pottery, &c., shipbuilding yards, and many other industries, make the valley of the Tyne and its ports one of the busiest and, it may be added, one of the dirtiest in the kingdom.

This concentration of population and activity of trade have, as will be seen, an important influence on the agriculture of the surrounding county.

Physical aspects.—In physical aspect Northumberland "is a tumbled incline of fells and ridges intersected by valleys, and subsiding eastwards from the hill borders of Scotland and Cumberland into lessening undulations and a shelving coast." * The western part of the county is entirely hilly or even mountainous. The Cheviot Hills, which lie partly in Scotland, project themselves considerably over the Border, and occupy an area of 90,000 acres in Northumberland. A continuation of this chain of hills separates Cumberland from Northumberland and runs into Durham. Their conical or dome-shaped summits range from 1300 to 2600 feet above the sea. Near the point where the three counties meet rises Kelhope Law to the height of 2208 feet. East of this range of hills lie detached masses of hill, among them Simonside, near Rothbury, about 1400 feet in altitude, and numerous moorlands lying 1000 feet or more above the sea.

Rivers.—The principal rivers rise in the western hills. The South Tyne enters the county from Cumberland in the extreme south-west. It runs in a northerly direction to Haltwhistle, where it turns eastward, receiving shortly afterwards the waters of the Allen from the south. Near Hexham it is joined by the North Tyne, which has come down from the north-west, having risen among the Cheviots on the Scottish border, and received in its course many tributaries, the principal one being the Rede. Below Hexham the river flows in a broad stream eastwards. Near Newcastle it receives the Derwent, which has risen near Allenhead, and has run a course of thirty miles partly on the edge of the county and partly through the county of Durham. From Wylam for nineteen miles to the sea the river is a wide estuary artificially deepened. In the valleys of these rivers there is charming and varied scenery as well as some excellent farming. The whole catchment basin of the Tyne with its tributaries is 1053 square miles.

The Wansbeck rises near Bellingham, a few miles east of Redesdale, and runs eastward by Morpeth to the sea at Cambois. The Coquet rises among the Cheviot Hills, and runs

* 'Encyclopædia Britannica,' Art. Northumberland.

eastwards by Rothbury to the sea at Warkworth. The Alne has a short course from the hills near Alnham, a few miles north of Rothbury, by Alnwick to Alnmouth. The Till, called in its upper course the Breamish, is an affluent of the Tweed, which it joins near Twizell. This river also rises in the centre of the Cheviots; for about 12 miles it flows eastwards, it then runs northwards past Chillingham, and thence in a N.W. direction by Wooler to the Border. A few miles below Wooler it receives the Glen, which gives its name to Glendale ward, the district which Mr. Grey selected as exhibiting the best examples of the turnip course of husbandry.* The Tweed is a Scotch river until within 16 miles of the sea. From Carham to Tweedmouth it divides England from Scotland.

Geology.—The principal geological features of the county are as follows.

The Coal-measures occupy a triangular space in the S.E. of the county. This triangle has its base on the Tyne, and its apex near Warkworth. Its eastern side is the sea, and its western side extends from Warkworth by Morpeth to Heddon-on-the-wall.

"There are also some detached coal-measures stretching from the main mass to the west into Cumberland." † Within this area are found no less than 20 valuable seams of coal, besides many minor beds of superior quality.

There are said to be 176 collieries in the county, and the output of coal is about 14 millions of tons in a year, and is continually increasing.

The greater part of this district is covered with boulder clay intermixed with deposits of sand and gravel. The surface is generally flat, and the soil intractable.

Fringing the coal-measures on the west is a narrow band of Millstone Grit, never exceeding 7 miles in width. This formation consists of sandstones, shales and coals, and is described by Prof. Lebour as "having no distinctive fossil remains and nothing peculiar to it but its position." ‡

To the west and north-west of the millstone grit is a broad band of Carboniferous Limestone, variously classed by different geologists and named by Prof. Lebour as Bernician, as expressing the peculiar character of the carboniferous limestone in Northumberland, the ancient Bernicia. The great limestone bed of this series is quarried everywhere throughout its course, and yields lead largely in the western mining district. Parallel to it runs a band of sandstone, much used for building

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* 'Journal of the Royal Agricultural Society,' vol. ii. p. 157 (1841).

† Lebour, 'Geology of Northumberland and Durham.' ‡ Ibid.

purposes, and rich in lead—other bands of shales, limestone, sandstone succeed. The series includes a number of coal seams, some of which are worked. Between the limestones and the coals are sandstones and grits, which in certain districts contribute largely to the features of the scenery. Of these are the bold cliffs sloping towards the Tyne near Corbridge and Haltwhistle, the Simonside Hills near Rothbury, the high moors between Redewater and Coquetdale, and the sandstone crags at the head of the Rede and North Tyne. Many basalt dykes cross the county, the most noticeable being the Great Whin Sill, which extends from the Cumberland border to the Kyloe hills, between Belford and Berwick. The soils on the Whinstone are generally fertile.

The Cheviot Hills are eruptive rocks of various kinds, granite, porphyry, quartz, felspar, &c.

The geological characteristics of the stratified rocks have an important influence on the agriculture of a district—they affect the elevation and the dip of the land, the drainage and the water supply. Where these rocks are exposed, they determine the character of the soil, its natural fertility, and its texture or working qualities. They also largely determine the composition of the alluvium on the valleys of the rivers, where the deepest and richest soils are generally found. But very frequently and over large tracts of country, the original strata are thickly covered with drift brought from great distances by glacial action, and compounded of many geological formations. Wherever this is the case, the nature of the soil is determined by the composition of this superficial deposit.

The soils of Northumberland were described by Bailey and Culley in their report to the Board of Agriculture (3rd ed., 1813) as mainly consisting of "a strong fertile clayey loam occupying a level tract along the coast:" "Sandy gravelly and dry loam turnip soil" on the banks of the Tyne, on the Coquet about Rothbury, and the Aln from its mouth to Alnwick—on Tweedside, and in the vales of Breamish and Till: "Moist loams on a wet cold clayey bottom," occupying a large portion of the county—prevailing most in the middle and S.E.: "Black Peat" in the mountainous districts.

Climate.—The agriculture of every district is as much determined by its climatic conditions as by the nature of the soil. The writer has been unable to obtain much reliable information on this point. The mean summer temperature of the east of the county is said to have been for four years 52·9 at Alnwick, and 55·1 at North Shields, while at Greenwich during the same years it was 59·9. In winter the records for the same places were, Alnwick 38·9, North Shields 39·0, Greenwich 39·4.

The following table has been compiled from Mr. G. J. Symons' 'British Rainfall.'

RAINFALL at different stations in NORTHUMBERLAND compared with that recorded at GREENWICH OBSERVATORY.

	Average 1860—1869.	Average 1870—1879.	Average 1880—1887.
	Inches.	Inches.	Inches.
N. Shields, Rosella Place	26·06	28·02	27·30
Whittles Dean	25·42	27·75	27·45
Ilderton (Lilburntower, near Wooler) ..	28·66	31·33	31·41
Allenhead	51·16	48·49	Discontinued.
Greenwich Observatory	25·18	25·39	24·11

The conditions of a low summer temperature, with a more than average rainfall, are favourable to the growth of Oats rather than Wheat, and to the successful cultivation of Turnips. The formation of the county, the elevation of a considerable portion of the land, and the moist climate, indicate a pastoral rather than a corn growing country.

Estates and Owners.—The county contains many large properties; one of them, that of the Duke of Northumberland, comprises 181,606 acres, or nearly ¼th of the whole county. The Parliamentary Return of owners of land * shows 22 proprietors of more than 10,000 acres each, and 141 owners of from 1000 to 10,000 acres each. A careful calculation from the figures given in this return shows the following facts as regards Northumberland and Durham, compared with England and Wales:—

Percentage of Total Area held by Owners.	Northumberland.	Durham.	England and Wales.
Of less than 1000 acres	16·50	39·90	43·38
Of 1000 and under 10,000 acres	36·53	33·04	40·30
Of 10,000 acres and upwards	46·97	27·06	16·32
	100·00	100·00	100·00

The excellence of Northumbrian farming, and the high character of its farmers, are in no small degree owing to the existence of these large estates. Certainly no county in England can show farms better provided with the necessary buildings. The farm houses are solid, comfortable homes, without much pretension in outward appearance, but containing

* Parliamentary Paper No. 335 of Session 1876.

excellent accommodation. The homesteads have almost universally a fixed threshing machine, driven either by steam or water power. The engine is usually employed to work a mill for grinding corn, a chaff-cutter, and a cake breaker; straw barns are always provided, and many hay barns have been put up of late years. Byres and feeding hovels with large shelter sheds for younger cattle, root houses, implement sheds, cart lodges, &c., are provided on a liberal scale, in proportion to the size of the holding. Cottages of very substantial character, and suitable to the habits and tastes of the Northumbrian hinds, are to be found on almost every farm. Bad buildings and bad cottages of course there are, but as a rule the landlords of the county have done their best to give the farmers, and their workmen, good homes and good buildings.

Size of Farms. — Large estates and large farms are very usually found associated together. In Northumberland a large proportion of the holdings are of more than the average size. Major Craigie, in a paper read before the Statistical Society in February 1887, deduces from the Agricultural Returns the fact, that in 1885 the average size of a holding in that county was 119·7 acres, while in Wilts, which ranks next to it as a county of large holdings, the average size was 100·2 acres, and for all England the average was 60 acres.

The Agricultural Returns for 1886 contain very full information as to the number of Agricultural Holdings of various sizes in every county. The following Table summarises the result of these Returns for the counties of Northumberland and Durham, and contrasts them with those for England generally.

Classes of Holdings *	Northumberland.		Durham.		England.	
	Percentage of Total Number of Holdings.	Percentage of Total Acreage in certain Classes of Holdings.	Percentage of Total Number of Holdings.	Percentage of Total Acreage in certain Classes of Holdings.	Percentage of Total Number of Holdings.	Percentage of Total Acreage in certain Classes of Holdings.
Of ¼ acre and not exceeding 5 acres ..	18·91	·45	19·33	·86	29·96	1·19
Above 5 acres and not exceeding 50 acres ..	36·74	5·71	44·07	12·50	41·08	13·13
Above 50 acres and not exceeding 500 acres	40·22	68·66	36·12	81·82	27·84	71·88
Above 500 acres	4·13	25·18	·48	4·82	1·12	13·80
	100·00	100·00	100·00	100·00	100·00	100·00

* In the Agricultural Returns the Classes of Holdings are 0¼ a. to 1 a.; 1 a. to 5 a.; 5 a. to 20 a.; 20 a. to 50 a.; 50 a. to 100 a.; 100 a. to 300 a.; 300 a. to 500 a.; 500 a. to 1000 a; above 1000 a.

These figures clearly show that large holdings preponderate in Northumberland, while in Durham a very small proportion of the total area is in holdings exceeding 500 acres. Holdings of 300 to 500 acres occupy 28 per cent. of the total area in Northumberland, 17·35 per cent. for England. Below 300 acres, every class of holding in Northumberland is below the average of England generally.

The usual period of entry is Old May-day (May 13th), and as a rule the out-goer has the crop of Corn growing on a definite proportion of the arable land. In practice this crop is valued to the incomer.

Northumberland was distinctly the county in England where long leases were in favour both with landlords and tenants, and the marvellous improvement which took place in its agriculture in the latter part of last and the beginning of this century was attributed to the security which these leases gave to tenants. A great change of opinion has, however, occurred, and it would appear from the experience of the Judges that yearly tenancies are now far more common than leases.

The Parliamentary Return, 1886, respecting Allotments, gives the following particulars for Northumberland:—

No. of agricultural labourers	8349
No. of labourers having ground for potatoes	3165
No. having a general run for a Cow	880
No. having a Cow run of a definite quantity of land	46
No. of allotments or field gardens not exceeding 4 acres detached from cottages	5391
No. of garden allotments attached to cottages and exceeding $\frac{1}{8}$ of an acre	2838

It is not pretended that all these allotments, gardens, &c., are held by agricultural labourers. No doubt miners, mechanics, and others, share in the advantages of these small holdings. On the other hand, it is extremely probable that hundreds of cases where a labourer has a piece of potato-ground allowed him in the fallow break of the farm at a low rent, or rent free, could not be known to the enumerators of allotments.

Extent and Distribution of Crops and Numbers of Live Stock in Northumberland and Durham.

The following Tables will convey a general idea of the present relative importance of different kinds of crops and of different descriptions of live-stock. The figures in the first set of columns below show the average proportion per 100 acres of cultivated land of the acreage under each kind of crop, bare fallow and grass, in 1886, in the counties of Northumberland and Durham, the figures for the whole of England being added for the sake of comparison. The figures in the second set of columns show the average proportion per 100 acres of arable land under each kind of crop.

Nature of Crop.		I. Proportion per 100 acres of Cultivated Land.			II. Proportion per 100 acres of Arable Land.		
		Northumberland. 1886.	Durham. 1886.	England. 1886.	Northumberland. 1886.	Durham. 1886.	England. 1886.
Corn Crops:—							
Wheat		1·54	4·49	8·67	4·05	10·67	17·3
Barley or Bere		5·47	4·45	7·62	14·41	10·59	15·2
Oats		8·32	8·76	7·11	21·90	20·82	14·1
Rye, Beans, Peas		·76	·68	2·48	2·01	1·62	5·
Total Acreage of Corn Crops		16·09	18·38	25·88	42·37	43·70	51·6
Green Crops:—							
Potatoes		·81	1·95	1·46	2·13	4·63	2·9
Turnips and Swedes.. ..		6·05	5·05	5·81	15·93	12·02	11·6
Mangolds, Carrots, Cabbage, Kohl-Rabi and Rape		·11	·14	2·01	·29	·33	4·0
Vetches and other Green Crops		·37	·84	1·54	·99	1·98	3·1
Total Acreage of Green Crops		7·34	7·98	10·82	19·34	18·96	21·6
Clover, Sainfoin, and Grasses under Rotation	For Hay ..	6·91	8·52	6·57	..	..	..
	Not for Hay	6·09	3·34	4·53	..	..	..
	Total ..	13·00	11·86	11·10	34·25	28·20	22·1
Permanent Pasture or Grass *Not broken up in rotation* ..	For Hay ..	9·62	20·78	15·29	..	..	..
	Not for Hay	52·41	37·16	34·52	..	..	..
	Total ..	62·03	57·94	49·81	..	..	..
Flax and Hops		..	..	·29	..	..	·5
Bare Fallow or uncropped Arable Land		1·54	3·84	2·10	4·04	9·14	4·2
Total		100·00	100·00	100·00			

The following Table gives similar particulars as to the different descriptions of live-stock in Northumberland, Durham, and England generally in the year 1886.

Nature of Live Stock.	Proportion per 100 acres of Cultivated Land.		
	Northumberland. 1886.	Durham. 1886.	England. 1886.
Horses, *as returned by Occupiers of Land*:—			
Used solely for purposes of Agriculture ..	1·87	2·68	3·08
Unbroken Horses and Mares kept solely for Breeding	·65	1·38	1·31
Total number of Horses	2·52	4·06	4·39
Cattle:—			
Cows and Heifers in Milk or in Calf ..	3·40	5·77	7·37
Other Cattle:—2 Years old and above ..	5·65	3·93	4·70
Do. Under 2 Years old	5·57	6·80	7·07
Total Number of Cattle	14·62	16·50	19·14
Sheep:—			
One Year old and above	76·14	29·75	40·19
Under 1 Year old	48·18	15·61	25·65
Total Number of Sheep	124·32	45·36	65·84
Pigs	1·59	2·20	7·56

As is the case throughout England, the area of cultivated land has increased to some extent. The arable land has, however, diminished. It now occupies 38 acres, while in 1867 it covered $47\frac{1}{2}$ acres out of 100. Corn crops are grown on 16 acres, and they were 22 acres per 100. Green crops cover $7\frac{1}{3}$ acres in place of 9 acres per 100. Forage crops occupy about the same proportionate extent as they did, and permanent pasture is now 62 per cent., while it was only 52 per cent. of the cultivated area in 1867.

Since that period Cattle have increased in numbers by 42 per cent., while Sheep have decreased at the rate of about 17 per cent., though recent years show a slight improvement in numbers. There are now about 124 per 100 acres, while, taking England as a whole, there are only 65 per 100 acres of cultivated area.

Northumbrian Farming.—The objects to which the Northumbrian farmers specially devote themselves are the breeding, rearing, and fattening of Sheep; the fattening of Cattle; and

the growth of Turnips, Oats, and Seeds. The special excellence of their practice is in the cultivation of the Turnip crop. This has been brought to the highest pitch of perfection. It is not only on soils which would be generally classed as turnip soils that magnificent crops of fine quality are grown, but on some of the stiff, intractable boulder clays they are successfully cultivated. Details of the methods of cultivation adopted will be given in the notices of particular farms. The growth of Corn is on many farms a comparatively unimportant part of the business. If it were not for the value of the straw for food and litter, the acreage would decline still farther. In the neighbourhood of large towns and collieries Hay and Straw are readily sold at high prices, and crops of Seeds, Clover, &c., are sold for mowing green at prices which excite the envy of an Eastern Counties' farmer. The Judges saw crops of Seeds which had been sold for 14*l.* an acre, the buyer doing all the labour of mowing, bundling, and carting away. In such districts dairy produce, poultry and vegetables are in great demand; and, on the other hand, the streets, the stables, the shambles, the cottage middens, the fish-curing establishments, &c., supply an enormous quantity of manure, which must be got rid of, and is in consequence obtained at very low rates. The whole conditions of agriculture are thus modified in the urban and mining districts.

The Northumbrian farmer excels in the economical management of labour. The labourers are physically a fine race; they are independent in character, and they know how to take care of themselves. But they are amenable to discipline; they will obey instructions, and, if they demand good pay, they are willing to give good work in return. The men are in the habit of working well together. The head ploughman sets the pace, and keeps his mates up to time; he is responsible for each man beneath him doing a proper amount of work.

The men are generally hired for the year, which begins with Old May-day (May 13th), and they are housed on the farm. The wages are generally the same throughout the year, and not, as in some counties, lower in winter and comparatively high in summer and harvest. At the present time they seem to range from 15*s.* to 20*s.* a week; the house being held rent-free, and a certain quantity of potatoes being generally provided. As a rule, the hind engages to find a woman-worker (formerly called a bondager) at a fixed rate of pay (now 1*s.* 3*d.* a day, with double pay for harvest time). This practice keeps many of the labourers' daughters and other single women at home. These women-workers do a good deal of the farm work. In winter they tie up the straw from the threshing-machine and stack it,

carry corn into the granary, clean and cut the roots, and feed the Cattle. In hoeing turnips they do as much work as the men, and it is no uncommon thing to see a gang of twenty women, men and boys, led by a woman who keeps the whole gang hard at work. So deftly do these women use the hoe, that it is seldom necessary for them to stoop for the purpose of singling the plants. The appearance of these women-workers belies the assertion that field work is injurious to their health.

Labourers' Cottages.—The cottages in which the labourers live are generally placed near to the farm-yard ; they frequently contain only two rooms, besides a pantry and entry. Both rooms are, as a rule, on the ground-floor, as the people have an almost invincible objection to sleeping upstairs. The living-room is larger than is usual in Southern Counties, and it need be ; for in it the cooking and washing have to be done, the meals are taken there, and several of the household sleep there. In this room there is always a large cooking stove, and generally on the opposite side of the room will be found two beds in recesses. The second room is a bed-room. Of course, there are cottages which give better accommodation in the shape of bed-rooms ; but the normal cottage is such as has been described.

Considering the number of single women who remain at home to work on the farm, the cottages must, in many cases, be overcrowded, and there can scarcely be that separation of the sexes which is desirable. One reason which was given for the two-roomed cottages was, that the hinds were hired annually, that they frequently changed their homes and masters, and that the hirer moved as much of their furniture as could be carried in one cart. But many of these cottages contain as much furniture as is necessary for a cottage with two more rooms. However, in almost every case where we made enquiries, we found the people satisfied with their houses, and certainly they were remarkably clean. Many of the houses were well furnished, and exceedingly comfortable. In some instances we found a remarkable deficiency of decent offices. After looking over the steward's cottage on a large farm, and admiring the neatness and order inside, we looked around the place outside, and could find no privy. We were told that this was no uncommon case.

In former days it was very generally the custom to pay the labourer to a great extent in corn and meal. This custom is now almost extinct, except among the shepherds on the hill-farms, who are frequently paid partly by the keeping of a certain number of sheep, which run with the master's flock. We also found several instances where the labourers owned cows, which were housed and fed on the employer's farm, and others where a

cow was provided by the farmer for the use of the labourer at a fixed sum per week.

Horses and Cattle.—It is not necessary to notice particularly the breeds of Horses and Cattle to be found in Northumberland, since they are such as may be met with in many other districts, excepting the Chillingham wild cattle, which are in some respects one of the most interesting herds in England. They are supposed to be the original British breed of cattle.

Sheep.—The sheep, however, are so important a branch of the farming, and they include such varied types, that it is impossible to pass over them without enumerating the principal breeds of the county.

The Cheviot, the Black-faced Mountain, and the Border Leicester Sheep are pure breeds of distinct character, existing in large flocks in different parts of the county. But on many farms cross-bred sheep are regularly bred, some by mating animals of two of these pure breeds, but frequently also by putting half-bred tups to half-bred ewes, and in many cases three-quarter-bred sheep are bred by putting a pure bred tup to a half-bred ewe.

The *Cheviot Sheep* claims the first notice, since it takes its name from the hills which are the most striking feature in the scenery of the county. The origin of this breed has been the subject of much speculation. Whether it is a native breed or imported cannot now be ascertained. That it was improved by the infusion of fresh blood is undoubted. Mr. Robson of Belford has the credit of crossing the breed with some tups from the South about 100 years ago. Whether these tups were Bakewell Leicesters or Lincoln sheep is disputed still, but the result was that his flock became famous and the general distribution of his rams influenced and modified the whole breed. It is pleasing to find the name of Robson still connected with the Cheviot sheep, and to see two gentlemen of this name winning nearly all the prizes for that breed at the Newcastle Show this year.

The Cheviots are a hardy, active breed, of rather small size, with a somewhat close fleece of fine white wool. The fleeces weigh about 4 lbs., and the wool makes a comparatively high price, 28*s.* a "tod" or 1*s.* a pound having been made this year in several cases. This breed is kept principally on the hills, where no food is brought except during a long blast of snow. They lamb on the hills in April, and are kept in the flock for three or four seasons, when they are drafted and frequently sold to graziers to breed a half-bred lamb. The wedder lambs are generally sold for feeding on turnips.

The *Black-faced Mountain Sheep* are believed to have had their

origin in South Scotland. When the breed of Cheviots was improved by Robson they supplanted the Blackfaces; but after a time the latter are said to have regained their position on the more exposed hills, and the breeders of this class of Sheep assert that they number fully one-third of the sheep in the North of England. They are said to have greater powers of endurance, to be braver feeders in the snow, and to be better sucklers than the Cheviots. They lamb early in April, and are kept in the flock until 5 or 6 years old. The wether lambs and cull ewe lambs are sold off in September. The wool is frequently shorn unwashed.

The *Border Leicester Sheep*, though springing originally from the famous Bakewell flock, as the Yorkshire and Midland Counties Leicesters did, have now become a distinct breed, with points of difference which the breeders consider of great importance; such as the colour of the face and cleanness of bone. The breeder of Border Leicesters speaks of the "Blue-faces" with a sort of contempt. The credit of introducing these sheep into Northumberland belongs to the Messrs. Culley, who occupied the famous farm of Wark on Tweedside in 1767. It is considered probable that crosses with the Cheviot have modified the original character of the Bakewell sheep, and soil and climate have also had their influence in creating a distinct type of sheep.

The various flocks of pure-bred Border Leicesters which are to be found in the county are maintained chiefly for the purpose of furnishing rams to be mated with ewes of other breeds. Cheviots, Black-faced Mountain, and half-bred ewes are crossed with them. Indeed, judging from the farms which came under the notice of the Judges, the flocks which prevail in the greatest numbers on such farms in Northumberland as include any considerable proportion of arable land, are composed of half-bred ewes with more or less of the Cheviot and Border Leicester blood in their veins.

Broadcast Sowing.—It may be well to notice in this place one peculiarity, or what struck some of us as such, in Northumbrian farming; the Corn is generally sown broadcast. No doubt there is a good reason for the practice, or it would not be followed by men so sagacious and so proficient in the arts of agriculture, but certainly in drilled corn they would have a better opportunity of keeping down the weeds which are often too prominently in view.

Implements.—The Northumbrian farmer is thoroughly awake to the advantages of modern machinery. The universal use of fixed threshing engines, and the application of steam or water power for various purposes, has been already noted. Among the implements generally in use in Northumberland and not

extensively known is a very primitive one called a "scrubber." It is used for breaking down the clods before ridging for roots, and it does this most effectually without pressing the land down too much. This implement, which may be knocked together by any hedge-carpenter, consists of 8 or 12 deal battens laid on one another like successive furrows, and kept in their places by cross-pieces on the top. The lower edges of the battens are shod with iron. The driver rides on the scrubber to keep it down to its work, and the effect of it on strong land is quite remarkable. Another very useful implement which was observed on several farms was a scarifier for use on turnips or other ridges. Instead of a roller which covers the whole ridge, two half-rollers are set at such a distance apart as to leave the plants untouched. Following these rollers on each side of the ridge are little skim-ploughs which shear away the earth and weeds from each side of the turnips. One of these tools which we saw at work was Anderson's patent, and was made by Gregory Westoe, South Shields. We understood that it cost about 5*l.* 10*s.* Another implement which surprised us, not by its novelty but by its survival, was the old lever turnip-cutter, which has elsewhere been supplanted by the rotatory slicers, but is still the cutter in use on every farm which we visited. The following is a description of this implement from Morton's 'Cyclopedia' (vol. ii. p. 1037):—

> "This cutter acts by direct pressure, somewhat after the fashion of a nut-cracker: the one cheek being an open harp of edges arranged in a cup-shaped manner and the other a block fitting these edges so that anything placed between the two is forced by the former through the latter. But one root at a time is cut, and it is delivered in slices below. Nothing can be more wasteful, whether of time or of form, than an arrangement such as this."

The tool must, however, be a good one, or it would not have held its ground.

DURHAM.

Having attempted to give a sketch, though a very imperfect one, of the prevailing characteristics of Northumbrian farming, it will be necessary to make some remarks on the agriculture of Durham. It may, however, be remarked that much of what has been written is equally applicable to all the eastern side of Durham, and particularly to that part of it which adjoins the Tyne and the town of Newcastle.

The County of Durham includes an area of 647,592 acres or 1012 square miles. It is separated from Northumberland on the north and north-west by the Tyne and Derwent, and from Yorkshire on the south and south-west by the Tees. On the west it is bounded by Cumberland, and on the east by the

German Ocean. If the writer had to confess that his personal knowledge of Northumberland was but slight and recent, he may add here that, inasmuch as the competing farms in Durham were only three, and as they were all situated in a small section of the eastern part of the county which has the city of Durham on the west, Sunderland on the north, and Stockton on the south, his opportunities of observation have been very slight.

Population.—The population of Durham was, in 1881, 867,586. As its area is only half that of Northumberland, and its population is just twice as numerous, it follows that the density of population is four times as great. Like Northumberland, the eastern side of the county is more crowded with inhabitants than the west, but the distribution is more even, as in none of the registration districts does it fall below 108 persons to the square mile.

Persons engaged in agriculture in 1881 numbered 12,993 males, and 4581 females, or 14,574 in all. Those engaged about animals were 1059 persons. These figures show less than 17 per 1000 of the whole population directly engaged in agriculture, and barely 20 per 1000 are included in the whole agricultural class. Agricultural labourers, farm servants, and cottagers were 6674 males and 1183 females; while shepherds were only 117 in number. In these two divisions of labour there were 7974 persons engaged. In one class the Census Returns show a remarkable difference between Northumberland and Durham. The latter county has 3710 persons returned as farmers and graziers, while the former, with twice the area, has only 3048 in that class.

It has been already pointed out that the number of persons directly engaged in agriculture is relatively far larger in Durham than in Northumberland. But nevertheless the whole agricultural class in Durham is far outnumbered by the miners, who were, in 1881, 67,500; while the carpenters, the shipwrights, the domestic servants, the milliners, the mechanics, and many other classes each greatly exceed in number the agricultural labourers.

Physical Features.—The western portion of the county is uncultivated moorland, covered with heather, and rising to an elevation of 1500 to 2200 feet. From Kilhope Law, near the junction of Northumberland, Cumberland, and Durham, the county slopes more or less gradually to the sea. The eastern portion of the county is bare and monotonous, except in the deep valleys, which are densely clothed with woods, and are very picturesque. The principal rivers are the Derwent, which, rising in the north-west, forms for a while the boundary between Durham and Northumberland. Near Ebchester it enters the county, and, after running for about 7½ miles

across its north-west angle, it falls into the Tyne at Derwenthaugh. The Wear comes from Kilhope Law and runs by Weardale to Stanhope, thence by Bishop Auckland and Durham to Bishop Wearmouth and Sunderland. The upper portion of Weardale is said to be a fine grazing district. The lower part of the course of this river is very circuitous, and the scenery near Durham is charming. The Tees rises in Cumberland, and forms for 60 miles the boundary between Durham and Yorkshire. The geological features of Durham are very similar to those of Northumberland.

"Magnesian limestone forms the coast from S. Shields to Hartlepool; new red sandstone extends thence to the Tees, and westwards up the lower part of the Tees valley. A coal formation occupies a space of about 25 miles by 10 in the central and northern parts of the county, and millstone grit, shale, sandstone, and carboniferous limestone, severally or variously occur in the west."—'Parliamentary Gazetteer.'

Mr. John Coleman, in his Report to the Duke of Richmond's Commission on Agriculture, describes the New Red Sandstone district as for the most part covered by drift clay, and the soil as poor in character. Where, however, the sandstone comes to the surface, as in the higher parts, the soils are friable and suitable for turnip-growing and sheep-breeding. Of the magnesian limestone district, he writes:—

"The surface, though occasionally covered by a strong drift, is generally derived from the decomposition of the limestone rock, and it is consequently of a fertile character, and, indeed, is by far the most valuable agricultural land of the country."

Of the coal measures he says:—

"A large proportion of the soil is of a good workable character, suitable for the growth of roots and their consumption on the land."

The Mountain Limestone district Mr. Coleman describes as "principally a wild, bleak district almost bare of timber."

Estates and Owners.—The distribution of landed property in Durham is less remarkable than in Northumberland. In the Parliamentary Return already referred to, only two proprietors are returned as having more than 20,000 acres, about 40 per cent. of the whole area is in properties of less than 1000 acres, and about 27 per cent. in estates of more than 10,000 acres.

Size of Farms.—There is a very marked difference in the size of holdings in Northumberland and Durham: 70 per cent. of the whole area returned is in holdings of from 50 to 300 acres, while less than 5 per cent. is in what may be called large farms exceeding 500 acres.

Allotments, &c.—The following particulars are abstracted from the Return of the Agricultural Department as to Allotments, 1886:—

Number of agricultural labourers, farm servants and cottagers (males)	6674
Number of labourers having ground for potatoes ..	693
Number having a general run for a Cow	91
Number having a Cow run of a definite quantity of land	63
Number of allotments or field gardens not exceeding 4 acres in extent detached from cottages	4703
Number of garden allotments attached to cottages	2576

The agriculture of Durham appears to present no very striking features, when looked at from the point of view of statistics. Like that of Northumberland, it is very much modified by the density of the population in certain parts, and the lively demand which this occasions for many farm products. Changes similar to those which have taken place in Northumberland have occurred in Durham. Arable has been converted into pasture, Corn has decreased considerably, but that decrease has been entirely in the acreage of Wheat. Cattle have increased in numbers, while Sheep have decreased, until they number only 45 per 100 acres of cultivated area, and only 30 per 100 acres of total area.

If, however, at the present time the county holds no prominent rank, it claims the honour of being the original home of the Short Horn cattle, in connection with which breed the names of the brothers Colling are household words.

The Competition.

The schedule on pages 602–3 contains a list of the farms entered for competition, and inspected by my colleagues and myself; and it also shows the awards made in each class.

Mr. G. M. Angus's Farm, High House, Matfen.

First Prize in Class I., and Champion Prize for the best managed Farm in Classes I., II., III., and IV.

This farm, which according to the certificate of entry contains 364 acres, is the property of Mr. John Clayton, of Chesters. It has been held by Mr. Angus and his father for more than fifty years, and indeed a portion of it was entered upon by a member of the family of Angus in 1815.

The tenancy is from year to year. The tenant is not restrained as to cropping. The landlord keeps all roofs in repair, and paints all outside woodwork every seven years. The time of entry is the 13th of May, and the outgoing tenant is entitled to an away-going crop on half the arable land. One-fourth of the arable would be left in new seeds, for which the outgoer would be paid seed and labour; and the incomer

The Competition.

The following Schedule contains a List of Farms entered for Competition in Classes I., II., and III.

	Name and Address of Competitor.	Name of Landlord.	Extent of Farm. Arable	Pasture.	Hill or Moor.	Total.	Soil.	Subsoil.	Tenancy.*	Remarks.
	Class I.—Arable and Grass Farms exceeding 300 acres.									
			A.	A.	A.	A.				
1	Angus, George Michael, High House, Matfen, Newcastle-on-Tyne	John Clayton, Esq. ..	161	200	..	361	Heavy.	Clay	Yearly.	1st Prize.
2	Angus, Messrs. Bearl, Stocksfield-on-Tyne	Wentworth Beaumont Blacket, Esq.	202	174	..	376	Large proportion heavy, remainder medium	Hard clay chiefly	Yearly.	H. C.
3	Lyall, John Knox, Peepy, Stocksfield-on-Tyne	Ditto	399	358	..	757	Light chiefly	Gravel	Yearly.	2nd Prize.
4	Weightman, W. A., Hall Farm, Silksworth, Sunderland	W. S. Robinson, Esq. ..	271	113	..	384	Part light, part very heavy	Clay, gravel and sand	Yearly.	R. N. & H. C.
	Class II.—Arable and Grass Farms from 100 to 300 acres.									
1	Bewick, Robt., Callerton, Ponteland	R. J. Graham, Esq. ..	117	43	..	160	Heavy clay and light	Gravelly	Yearly.	
2	Davison, Wm., East Mills, Morpeth	His Grace the Duke of Portland	94½	96½	..	191	Light	Sandy loam	Yearly.	2nd Prize.
3	Hall, John, Middleton House, Thorp, Stockton	The Rt. Hon. Visct. Boyne	139	62	..	201	Heavy	Chiefly clay	Yearly.	

4	Hargrave, J. S., Denton, Newcastle-on-Tyne	R. Lamb, Esq., J. Henderson, Esq., and Lord Rokeby's Trustees ..	92	24	..	116	Medium	Clay	Yearly.	
5	Lawson, John, Lower Cocken, Fencehouses, Durham ..	The Rt. Hon. The Earl of Durham	77	33	..	110	Light	Sand	Yearly.	
6	Nixon, W. N., Union Hall, Newcastle-on-Tyne	His Grace the Duke of Northumberland ..	151	59	..	210	Light	Gravel and clay	Yearly.	
7	Reay, John Ridley, Kenton, Newcastle-on-Tyne	Lord Rokeby's Trustees	163	76	..	239	Heavy	Very changeable	Yearly.	
8	Robson, John, Newton, Bellingham	Jacob Robson, Esq. ..	40	86	..	126	Light	Mostly sand	Yearly.	
9	Wilson, Fenwick, Marden, Whitley	His Grace the Duke of Northumberland ..	166	54	..	220	Part light, part heavy	Clay	Yearly.	1st Prize.
		CLASS III.—HILL OR MOOR AND ARABLE FARMS.								
1	Barber, Anthony, West Weetwood, Wooler	Sir H. Clavering, Bart.	400	70	500	970	Light turnip soil	Clay and gravel	Yearly.	R. N. & H. C.
2	Drysdale, George, Great Ryle, Alnwick	The Rt. Hon. the Earl of Ravensworth	390	107	124	921	Variable, mostly light	Lowland, sandy clay. Highland, whinstone	Lease of 21 years.	1st Prize.
3	Davison, Hedley, Scrainwood, Rothbury	W. C. Selby, Esq.	273	384	405	1062	Both light and heavy	Some clay, some sand	Yearly.	2nd Prize.

* It may be remarked that, with the exception of one farm in CLASS III., all the tenancies are from year to year.

would have a right of pre-entry for the purpose of cultivating the remaining one-fourth of the arable land.

The farm is situate about 14 miles west of Newcastle, and 7 miles north of Stocksfield-on-Tyne. It lies a little to the north of the Roman wall, and is at an altitude of from 420 to 480 feet above sea-level. Its position is remote, as there is no railway station within 7 miles, and all the purchased manures and feeding-stuffs have to be hauled this distance over a hilly road. The climate is not very favourable, and it is said to be fully a fortnight later than that of the Tyne valley, which is only a few miles to the south.

The farm is, roughly speaking, contained in a parallelogram, which has sides of about a mile and a half from north to south, and about 25 chains from east to west. About half a mile from its southern boundary it is cut in two by a public road, and here at the highest part of the farm the homestead is placed. From the road the land slopes downwards to the north and south. Near the northern extremity is a second range of buildings.

The house is a comfortable one, and has in front a small flower-garden, and on the west an excellent orchard and kitchen-garden. It is often said that good farmers are bad gardeners, but certainly in almost every case where the Judges could commend the management of the farm, they could also say that the garden bore evidence of great care and attention. The home buildings are commodious, and well arranged. A fixed steam-engine threshes the corn and works a pair of stones, corn-crushing rollers, a chaff-cutter, and a cake-breaker. The waste steam is employed in steaming chaff, roots and meal. There is a straw-barn and corn-dressing-barn, also a hay-barn [55 feet × 20 feet × 15 feet to eaves] capable of holding 100 loads of hay, and extensive byres and feeding hovels, stables, root-houses, mixing-room, cart lodges, &c. The outlying set of buildings comprise a byre, hay-house, root-house, sheds and yards, accommodating 40 head of cattle.

There are five cottages on the farm. These are occupied by the foreman, shepherd, and draughtmen or carters. They are of the ordinary type of Northumberland cottages. One which we visited had a living-room, a bed-room, and a pantry, and nothing more. Another had a large living-room, and behind it three small cells—one of which was used as a bed-room, one as a scullery, and the third as a pantry.

The soil is for the most part strong clay on the magnesian limestone. On no part of the farm can turnips be fed off on the land. The southern portion is much inferior to that on the north, where there is a fine tract of pasture, some of it

capable of feeding a bullock to the acre. One of the best of these fields is said to be the site of an ancient village which has entirely disappeared, though traces of buildings are clearly visible. Another pasture of 50 acres rejoices in the name of Creamy Riggs, and it is remarkable for its high-backed ridges, which rise at least three feet above the old furrows. At our first visit in December the deep furrows were filled with water.

On the east side of High House Farm Mr. Angus occupies another farm of about 120 acres, called Butcher's Hill. This farm was not entered for competition, as it had been taken only a few years ago in a foul and exhausted condition. The Judges thought it their duty to inspect this farm, as it was worked with High House; and though they could understand the reasons which induced Mr. Angus to withhold it, they saw nothing which would affect the opinions they had formed from the inspection of the competing farm. High House Farm is said in the entry form to contain 200 acres of pasture and 164 acres of arable, but an inspection of the map which was annexed showed 194 acres of pasture, 152 acres of arable, and 10 acres of plantation, or 356 acres in all, leaving 8 acres unaccounted for. This quantity is probably taken up by roads, buildings, stackyards, house, cottages, and gardens.

The schedule on page 606 shows the cropping of the different fields in 1887. The system of cultivation of the arable land is pretty clearly indicated by this schedule.

Seeds are sown in a corn crop where two crops of roots have been grown at very short intervals, and the land has thus been thoroughly cleaned. The seeds sown for 4–6 years' ley are these:—

5 lbs. Red Clover.	$\frac{1}{3}$ bush. Italian Rye-grass.
2 „ White „	
2 „ Alsike „	$\frac{2}{3}$ „ Perennial Rye-grass.
2 „ Cow-grass.	
3 „ Cocksfoot.	
2 „ Timothy.	
16 lbs. heavy seeds.	1 bushel.

The seeds are mown in the first year, after being top-dressed with 2 cwt. bone-meal, 2 cwt. superphosphate, and 1 cwt. nitrate of soda. After the first year the seeds are grazed with Cattle and Sheep receiving artificial food. The seeds lie from four to six years, and are then broken up in December or January for Oats, which are sown in March, and the crop is top-dressed with nitrate of soda and salt. The Oat crop is followed by Turnips or Swedes. The stubble is ploughed 10 to 12 inches deep as early after harvest as is possible, and it is never

Cropping of Different Fields in 1887.

No.	Acreage.			Crop in 1887.	Remarks.
1	24	0	20	Old grass-hay ..	About 8 acres laid down 16 years ago.
2	18	0	36	Seeds, hay ..	1st year.
3	21	3	15	Pasture.	
4	7	1	3	"	
5	6	2	6	"	
6	50	0	13	"	
7	38	0	1	"	½ mown, ½ grazed alternately.
8	5	1	27	Seeds	5th year.
9	8	1	27	Barley	After Turnips.
10	24	2	6	Pasture.	
11	12	0	12	Oats	After Turnips.
12	17	1	36	"	After 5 years Seeds.
13	17	0	15	Swedes	After Oats.
14	3	0	0	Pasture.	
15	4	1	13	"	
16	14	1	10	"	
17	11	2	1	Seeds	6th year, to be ploughed out this year.
18	14	2	11	Turnips.	
19	7	0	14	Seeds	5th year.
20	14	0	34	Seeds	2nd year.
21	7	1	20	"	5th year.
22	10	0	0	Plantation.	
23	8	0	5	Seeds	3rd year.
24	10	2	23	Oats	After Turnips.
	356	0	28		

		Area.			Percentage of Cultivated Area.
		A.	R.	P.	
Summary	Arable	152	0	21	43·9
	Pasture	194	0	7	56·1
		346	0	28	100·

Acreage and Proportionate Extent of Different Crops in 1887.

Corn Crops.	A.	R.	P.	Green Crops.	A.	R.	P.	Grasses in Rotation.	A.	R.	P.
Barley ..	8	1	27	Swedes and Turnips	31	2	26	1st year ..	18	0	36
Oats	40	0	31					2nd year ..	14	0	34
								3rd, 5th & 6th years ..	39	1	27
Total	48	2	18		31	2	26		71	3	17
Percentage of Arable Land ..	32·				20·8				47·2		

ploughed a second time. If possible it is ridged in the winter, but this year that could not be done. The land is worked as often as necessary with a scuffler, which goes to the bottom of the farrow. If necessary, the clods are broken by repeated "scrubbing," and the rubbish is removed. It is then ridged (called "drilled" in Northumbria), and the manure is applied, the ridges are split, and the seed immediately sown. The manure applied to the swedes in the present year was—

16 loads (about 15 cwt. each) of rotten farmyard-dung.
2 cwt. bone-meal.
2 „ dissolved bones (guaranteed).
2½ „ mineral superphosphate.

One portion of the field sown with yellow and white turnips received this year

14 loads of yard-dung.
7 cwt. bone-meal, dissolved bones, and mineral superphosphate in equal quantities.

The other had 5 cwt. pigeon-manure and 5 cwt. of dissolved bones, bone-meal, and superphosphate. This pigeon-manure is bought of men who go about collecting it; it costs *3l.* a ton. It is kept from six to twelve months before using, and having been covered over with ashes, it is turned two or three times and thoroughly mixed. It is considered by Mr. Angus the best manure he can use for turnips. It has been already said that all the turnips have to be removed. The crop is followed by Wheat, Barley, or Oats, according to circumstances. This year no Wheat could be sown at the proper time, which should not be later than January. This second Corn crop is followed by a second Root crop, which gives an opportunity for a thorough cleaning of the land. With the third Corn crop Seeds are again sown, and the round is completed.

To recapitulate briefly, the course of cropping is this :—

1st Year.	2nd Year.	3rd Year.	4th Year.	Two to Six Years.	
Turnips or Swedes	Corn	Turnips or Swedes	Corn	Seeds.	Oats

The most noticeable feature of the preceding schedule is the very small breadth of corn. A reference to the Table (p. 592) will show that, taking the average of Northumberland, 42 per cent. of the arable land is in Corn: but on this farm there is only 32 per cent., while nearly one-half of the arable is in Artificial Grasses.

The main business of the farm is the production of meat, and all the Cattle and Sheep are sold off fat. Mr. Angus has for many years regularly supplied a butcher with Beef and Mutton, which has all been sold by weight—the practice being for the butcher to come once a fortnight to choose the supply for the next two weeks, and to pay for those last drawn. The price per stone having been agreed upon, the weighing of the animals has been left to the butcher. This system has been followed until the present summer, when the butcher retired from business, and Mr. Angus had to look for a market at a very unfortunate period of excessively low prices.

To keep up a constant supply of fat animals would tax the resources of most farmers, and no small amount of skill and judgment has been shown in accomplishing the feat.

About seven score breeding ewes are kept on the farm. These are pure half-bred ewes. The tups used are Border Leicesters and Oxford Downs of Mr. John Treadwell's well-known flock. The greater part of the lambs are sold fat, and for this purpose those by the Oxford Down are preferred by the butcher, though Mr. Angus thinks the produce of the Leicesters equally good in every respect. Many of the ewes are fattened off every year, the flock being kept up to its number by the purchase of about 30 gimmers and 30 four-year-old ewes every year. In the autumn, lambs from the north are bought in; but they have to be wintered elsewhere. They are sent out in November; and last year they cost 5*d.* a head a week, besides an allowance of ½ lb. of cake a-day. They return in February, and are folded on grass, where they get cut turnips and cake, and they go away fat in the spring and summer.

With the exception of four dairy Cows, which are kept for the purpose of supplying the house and the labourers' families with milk and butter, no breeding of Cattle is attempted. Two-year-old steers and heifers (chiefly Irish) are bought from time to time at Carlisle or Stagshaw Bank* or elsewhere, and feeding is carried on throughout the year—all the forward animals getting a liberal allowance of cake when at grass.

Our first visit to Matfen was made on the 15th of December, on one of the wettest and roughest days of a very stormy period. We started from Newcastle before daylight, and we seemed to be driving for an interminable time over the heaviest of roads, up hill and down hill, through storms of snow, and rain, and hail. Our driver took us some miles out of the way, and

* Six fairs are held during the year on a common about four miles from Hexham and about the same distance from Matfen.

considerably shortened the day in which we had planned to inspect two other farms besides this one. We first looked over the homestead, which was crowded with feeding Cattle, and afterwards walked to the extreme end of the farm to see some Cattle which were out at grass. We took the opportunity to look at the turnips and swedes, and we found them good in quality.

On this occasion the stock on the farm consisted of:

7	*Horses*:—	7 working horses.
143	*Cattle*:—	4 cows.
		8 calves.
		115 feeding steers and heifers in byres or yards.
		16 „ „ on grass.
140	*Sheep*:—	140 ewes on grass.

We were told that 140 lambs (60 of which had been bred on the farm, the remaining 80 having been bought in), had been sent out to keeping in November.

The Horses were of a good working type.

The Cattle, which were in various stages of forwardness, were not very uniform in character, but they were on the whole well chosen and well cared for. They were getting 4 lbs. of mixed linseed and cotton-cake, and 3 lbs. of steamed meal with chaff, and about 60 lbs. of sliced turnips a-day. The Cattle at grass had the protection of a shelter shed, and notwithstanding the inclemency of the weather, they looked well and thriving.

The ewes were on grass, and got some turnips and turnip-tops. The winter allowance is 1 ton a day among 140 of them. They were timed to lamb in the third week of March, and when suckling their lambs would get from ½ lb. to 1 lb. of cake, oats, maize and bran mixed, and an allowance of chopped hay and straw.

Our second visit was made on the 25th of May, and again the weather was far from propitious. It was bitterly cold, and in the afternoon it rained continuously. On this occasion we had given ourselves a whole day for the inspection, and we visited every field on the two farms, and saw every head of stock on the place. Nearly all the feeding cattle had been sold from the byres; the pastures were stocked, but owing to the late and cold season grass was far from abundant, and the full quantity of stock had not been laid on. The seeds and old grass intended for hay were only just cleared. The ewes and lambs, which were divided into several lots and distributed about the farm, were in excellent condition, and the lambs,

of which there were something more than 200, were many of them fat; indeed, the sales of them began in the week following. Of the 140 hoggets which had been sent out to keeping, only 68 now remained, the others having been marketed, and those left were ready for sale.

Among the feeding Cattle we particularly noticed 13 heifers and 38 steers, which gave promise of being ready for the butcher in June. The Barley and Oats were backward but fairly promising. Seventeen acres of very strong land had been brought down into a good tilth, and the swede turnips were just making their appearance. Another field of 14 acres was then receiving its last grubbing before being ridged and sown with common turnips. On our next visit we learned that this sowing was done on the 4th of June.

During the winter 22 acres of old grass had been drained at the cost of the landlord. The drains were 8 yards apart and 3 feet deep; 2½-inch pipes were used. Both this field and another of 19 acres intended for hay had been top-dressed with bone meal, superphosphate and nitrate of soda.

On the Butcher's Hill farm we found about 65 acres of grass and 55 acres of arable land; one-fourth of this was Barley, one-fourth Oats, one-fourth Seeds, and one-fourth Roots.

Our third and final visit was paid on the 6th of July, and for the first time in our experience the sun shone on High House. Our route round the farm was the same as on the last visit, and a few notes on the several fields may not be thought out of place.*

1. Grass laid for hay very late—top-dressing had not taken full effect owing to drought. Light crop.

2. Seeds first year. Fine crop now in cock.

3. Grass pasture. No water supply; grazed therefore with 8 and 10; 26 head of cattle and 60 ewes and lambs.

4, 5. 13 fat heifers, very good. These were sold at Newcastle in the following week at 21*l.* each—not a high price, but the state of trade at the time was very bad.

6. 38 fat steers and 45 cast ewes; very good.

9. Barley after turnips; good crop, clean.

11. Oats after turnips, of a new or newly-named sort, Barraclough, apparently a White Tartar oat; good crop.

12. Oats after 5 years grass; very uneven, and not clean.

13. Swedes; fair plant, clean, had suffered from drought.

14, 15, 16. Home paddocks; milch cows good, ewes and lambs.

17. Seeds of sixth year; young steers.

18. Turnips, Yellow Bullock and Green Globe White; fair plant, partly singled, but not entirely. Compared part of field sown with farmyard-manure and 7 cwt. of artificial manure, as described p. 607, with that sown with 5 cwt. of pigeon manure and 5 cwt. of same mixture as before; marked difference in favour of latter treatment.

* The numbers refer to those of the Schedule.

19, 20, 21. Seeds of second and fifth year; grazing heifers, ewes and lambs.
23. Third year's seeds; young ewes, nearly fat; from them lambs have gone away fat.
24. Oats after turnips; fair crop.

The numbers of Cattle and Sheep on the farm at this time were as follows:—

112 Cattle, viz.:—5 fat in byre.
13 heifers, fat.
38 steers, most of them fat.
24 feeding heifers.
12 grazing heifers for wintering.
8 cows.
3 stirks.
9 calves.

310 Sheep, viz.:—45 cast ewes and shearlings, fat.
104 ewes and rams.
146 lambs.

Since our last visit 18 head of fat cattle had been sold at 16*l.* 10*s.* and 17*l.*; 62 shearlings and cast ewes, averaging 44*s.*; 60 lambs, averaging 34*s.* 6*d.*

The following are the wages of the labourers employed on this farm:—

	Wages per week. *s.* *d.*	
Steward	18 0	*Perquisites.*—All have cottage and garden rent free, half-a-ton of potatoes, 1*l.* in lieu of dinners formerly provided in harvest.
Shepherd	17 6	
Horsemen	17 6 and 17 0	

The stackyard was very neat, and the fences and gates throughout were in excellent order. In this and every other respect the farm presented a striking contrast to much of the land in the immediate neighbourhood.

Mr. Angus keeps accurate and detailed accounts of receipts and expenditure, and these were open to the inspection of the Judges, who were furnished with copies of the balance-sheets for the last two years. As, however, he preferred that these should not be published, his wishes have been respected. The following items have been abstracted:—

[The accounts refer to the whole occupation, 484 acres, with a little more than 200 acres of arable. The year ends 13th May.]	1886.	1887.
	£	£
The expenditure on labour was in round figures	390	399
That on cake	584	471*
" " manure	160	159

* In this year a larger quantity of home-grown corn was used for feeding.

More than 95 per cent. of the receipts were from meat and wool; the latter being an insignificant item, though it nearly equals the corn in amount. The details of the sales of Cattle and Sheep are these:—

SALES of CATTLE and SHEEP, MAY, 1885–1887.

	Number.	Weight.	Value.	Total Value.
Cattle:—		Stones.	£ s. d.	£ s. d.
Year ending 13th May, 1886	175	8,352	3,491 5 7	
	1	..	26 17 4	
Total..	176	..	..	3,518 2 11
Year ending 13th May, 1887	175	8,533½	3,215 12 5	3,215 12 5
Sheep:—				
Year ending 13th May, 1886	221	1,168¾	565 11 0	
	24	..	62 4 3	
Lambs	212	..	370 16 0	
Total..	457	..	..	998 11 3
Year ending 13th May, 1887	134	666½	345 0 5	
	46	..	109 0 8	
Lambs	182	566¼	294 6 11	
Total..	362	..	..	£748 8 0

Figures such as these are so rarely met with that they are worth analysing. We find from them the following results:—

	1886.	1887.
Average weight of Cattle sold by weight ..	47·7 st.	48·3 st.
" " Sheep " " ..	74 lbs.	69½ lbs.
" " Lambs " " ..	..	43½ "
	£ s. d.	£ s. d.
Average value of Cattle	19 19 9	18 7 6
" " Sheep	2 11 3	2 10 5
" " Lambs	1 15 0	1 12 4
Average price of Beef, per stone	0 8 4¼	0 7 7¼
" " Mutton "	0 9 8	0 10 4¼*
" " Lamb "	..	0 10 4½

While Mr. Angus's balance-sheet contains that essential item, a valuation of live and dead stock at the commencement and conclusion of the financial year, it does not particularise the

* Mr. Angus explained that whilst in 1886 the Sheep were most of them shorn before sale, in 1887 many were sold in the wool.

value of the live-stock at the two periods. It is therefore impossible to deduce from the accounts what is the value of the meat produced. In the long run and for a series of years this amount will be the gross proceeds less the cost of the stock bought, but a period of one or two years does not afford the basis for a reliable statement on this point. Seeing, however, the very regular system pursued on this farm, it may be worth while to apply this test.

	£	s.	d.
In the year ending 13th May, 1886, the sales of live-stock and wool were	4595	7	6
In the following year they were	4022	1	5
	8617	8	11
In the same years the cost of stock purchased was	4335	5	2
And the two years' balance, after deducting purchased stock from stock sold, was	4282	3	9
In this case, however, some keeping has been purchased at a cost of	165	19	2
And the balance is reduced by that amount to	£4116	4	7

Assuming that the stock in May 1887 was equal in value to that in May 1885, there was in the two years a gross production of meat of the value of 2058*l.* a year, or 4*l.* 5*s.* an acre over the whole farm.

But this amount is not all the produce of the farm itself, though made upon it, as manure and food have been purchased. When the cost of these items of expenditure has been deducted from the gross receipts, the actual value of the entire produce of the farm without extraneous aid is 3*l.* 6*s.* an acre, out of which the landlord, the tax collector, the labourer, and the tradesman have to be paid before the farmer gets anything. The practical result of the whole thing is that Mr. Angus gets a profit; but it is by no means an adequate one, considering the capital, the skill and energy which he employs in his business.

Mr. Angus spoke in the highest terms of his landlord, Mr. Clayton, who had shown his appreciation of a good tenant by carrying out various improvements which had been suggested. The relations between landlord and tenant were evidently most cordial, and since our award was made, Mr. Clayton has recognized in a kindly and graceful manner the well-deserved success of Mr. Angus.

The Judges had the pleasure of receiving from Mr. Angus a grateful testimony of the services of his shepherd, Christopher Pollard, who had served under him and his father for 27 years. He was now 67 years old and had 5 children out in the world. The old man showed us his pig with great pride, and we were

informed that he had taken nine or ten prizes for pigs at a local show of cottagers' pigs. We afterwards heard that when the news of his master's success in this competition arrived he burst into tears, and wished that his old master was alive to hear of his son's success. There is no need to enlarge upon the good feeling which exists between master and servant.

In deciding upon their award of the first prize to Mr. Angus, the Judges had in view the uniformly good management which prevails in every department of the farm work. With no advantages of climate, situation, or soil, excepting about 60 acres of pasture land, a system of legitimate farming is carried on with great judgment in the selection of stock, and great skill in preparing them for market. In this case there are none of the advantages which accrue from proximity to a market for hay and straw and forage and roots. In no way could the produce of an outlying farm be so cheaply transferred to the consumer as in the form of meat. It may be said that the farm exhibits no striking instance of a departure from the old routine of farming, and no grand results. The system of farming is one which is well adapted to the situation. The land is not merely kept in good condition, it is being enriched and improved. One criticism, made by the Judges of Class 4, who inspected this farm for the Champion prize, should be recorded. It was that Mr. Angus was using large proportions of his cake upon the best grass, which did not require manuring, while the poorer lands, which most required assistance, got least. The answer to this is that the cake is given most liberally to the forwardest animals, and these could not be finished off on the poorest land.

The Judges, after very carefully comparing the merits of the different farms, unanimously awarded the first prize to Mr. Angus.

Mr. J. K. Lyall's Farm, Peepy, Stocksfield-on-Tyne.

Second Prize in Class I.

This farm, which contains 757 acres, is the property of Mr. W. W. B. Beaumont, M.P. It has been in Mr. Lyall's occupation since May-day (13th May) 1876.

The tenancy is from year to year, with 12 months' notice to quit. The entry is on the 13th of May, but the incomer has a right of pre-entry to the fallows after the end of November and to a portion of the grass-land on the 25th of March. One hundred and twenty acres of the grass have to be cleared of stock from the 1st of January. The outgoing tenant has a right to an

away-going crop of corn limited to 180 acres; in practice the crop is purchased by the incomer. In Mr. Lyall's case the crop was valued during the harvest after his entry and paid for by him. The tenant is bound not to sow two corn crops in succession, and he is forbidden to sell hay, straw, or turnips. He has to keep in repair all buildings and fences.

The rent of the farm was at first 1127*l.*, it is now 812*l.* It is tithe-free, the tithe rent-charge having been redeemed by the owner. The rates have been on the average 125*l.* a year, they were last year 98*l.* 12*s.* 5*d.* The rent is thus about 21*s.* 6*d.* and the rates 2*s.* 3*d.* an acre.

The farm is charmingly situated on Tyneside, about 14 miles west of Newcastle, 7 miles east of Hexham, and about 1½ mile to the north of Stocksfield Station, on the Newcastle and Carlisle Railway. The approach to the farm from the railway leads over a handsome bridge which crosses the Tyne in one of its prettiest reaches, with the woods and grounds of Bywell Hall, the ruins of Bywell Castle, and the two ancient churches grouped together.

The farm runs down to the Tyne on the south-west and south-east, and is there about 50 feet above sea-level. From these points it slopes upward until at the Homestead, near the centre, a height of about 160 feet is reached; from thence there is a gradual rise towards the north-west, where 250 feet is reached. Towards the north, after a slight fall to the brook, there is a steep rise towards the east and north-east, where the altitude is 387 feet. A large proportion of the land lies between the levels of 100 and 200 feet. Two brooks run through the farm from the north and west, and water the grass-lands. A high road skirts the farm on the south, and another runs on the northern edge, and a third road completely intersects the farm from north to south. On this road the Homestead is situated—the farm-house standing in front to the south, the buildings and stackyard behind, and the labourers' cottages facing the buildings from the opposite side of the road.

Many circumstances contribute to render this farm a most attractive one. The position is as convenient as it is delightful; the climate is good, and early. In the autumn of 1886 the harvest was completed here before the weather broke, while only a few miles away to the north the whole of the corn was standing out for weeks afterwards.*

In the spring of the present year, and at the close of the month of May, all vegetation was quite as forward in the Tyne

* Mr. Lyall began cutting corn on the 30th of August, and finished harvest on the 26th of September.

Valley as it was in the eastern counties, or even as far south as the neighbourhood of London.

The soil is most of it light and easily worked, and being much of it upon gravel, the grass comes early in the spring. This warmth of soil has, however, its disadvantages in such a season as that of 1887, as was sufficiently evidenced when the Judges made their final inspection in the first week of July.

The farm-house, which is new, is excellent, and the view from it looking over the well-wooded Tyne, with the Durham hills in the distance, is very pleasing. There is a nice flower-garden in the front, and a good kitchen-garden behind the house. These gardens were very neat, and well cared for. Immediately behind the house are the farm-buildings, which are large, and very substantially built. They were originally constructed for the use of a former occupant of the farm, Mr. Atkinson, who was a famous Shorthorn breeder, and they are better suited for that purpose than for Mr. Lyall's business. They are too much cut up into separate boxes to be economically attended to. They are, however, so good in many respects that it seems almost censorious to find fault with them.

The barn has a fixed threshing-machine, worked by a ten-horse power steam-engine, which also drives a pair of mill-stones, a cake-breaker, and a chaff-cutter. There is a large straw-barn, with granary above, and all the ordinary farm-buildings on a liberal scale. Something like one hundred head of cattle can be wintered in these buildings and the enclosed yards. The farmer of these days uses a much greater number of implements than those of former times, and Mr. Lyall, finding that he had not sufficient room for his, has recently built a shed for that purpose at his own expense. He has also built a lambing yard, and constructed a sheep-dipping tank.

There are eight labourers' cottages, in two blocks of four each. These are very superior to the ordinary Northumbrian cottages. They have a living room 16 × 16, with a recessed cupboard, a small scullery, a pantry, and two bedrooms in the upper story. Of course there was the family bed in the living room, opposite to a large kitchen range, in which a big fire seems to burn winter and summer. The cottages which we entered were well furnished and scrupulously clean. In one of them we spied, among other books, an odd number of the Royal Agricultural Society's 'Journal'; but as the cottager was not present, we did not discover how it came there.

The soil is described as chiefly light on gravel; it is not deep, and it will bear very liberal manuring. In the south-east angle of the farm are some large park-like pastures of fair quality and well watered, and the house is surrounded on all

sides by grass-land, the principal part of the arable land lying on the north-west, with a slope to the south-east; another block lies on the north-east, with a steep slope to the west; and a third runs almost down to the Tyne.

The following schedule shows the cropping of the several fields in 1887:—

No. on Map.	Quantity.			Crop in 1887.	Remarks.
1	34	3	3	Pasture	
2	86	1	15	"	
3	29	2	2	"	
4	22	2	38	Grass for hay	
5	22	1	20	Turnips ..	Swedes, Old Meldrum and Gr. top white.
6	30	0	12	Seeds	1st year after Oats and Barley.
7	16	2	5	Oats	After 3 year's Seeds.
8	7	3	19	Pasture.	
9	21	2	32	"	
10	19	1	25	Seeds	3rd year.
11	20	0	19	Grass for hay	
12	7	3	22	Pasture.	
12A	17	1	23	Grass for hay.	
13	16	0	33	Seeds	2nd year.
14	14	1	3	Pasture.	
15	34	1	25	Oats	After 3 year's ley.
16	37	3	8	Seeds	½ 1st year, ½ 2nd year.
17	17	0	23	Potatoes, 5½. Turnips, 11½	Green top white.
18	18	2	18	Oats.	
19	23	2	37	Seeds	For Hay, 1st year.
20	15	3	17	Wheat.	
21	34	1	25	Barley, 24. Oats, 10.	
21A	8	3	9	Swedes.	
22	11	2	30	Seeds	2nd year.
23	15	0	33	Pasture ..	
24	23	2	7	Mangolds, 4½. Turnips, 19 ..	Old Meldrum.
25	21	1	28	Barley.	
26	58	2	7	Pasture.	
27	24	3	37	Seeds	3rd year.
28	19	3	28	Pasture.	
29	22	2	32	Seeds	2nd year.
	1	3	21	Homestead, Stackyard, &c.	
	757	3	16	Total.	

		Acreage.			Percentage of Cultivated Area.
		A.	R.	P.	
SUMMARY ..	Arable	399	2	31	52·9
	Pasture ..	356	1	4	47·1
	Total	755	3	35	100·0

Acreage and Proportionate Extent of each kind of Crop in 1887.

Corn Crops.					Green Crops.					Grasses in Rotation.				
	Acreage.			Percentage of Arable Land.		Acreage.			Percentage of Arable Land.		Acreage.			Perce- age Aral Lan
	A.	R.	P.			A.	R.	P.			A.	R.	P.	
Wheat	15	3	17	4·0	Turnips	38	0	10	15·5	1st year	72	3	9	
Barley	45	2	28	11·4	Swedes	23	3	9		2nd ,,	69	1	23	46·
Oats..	79	2	33	19·9	Mangolds	4	2	0	1·1	3rd ,,	44	1	22	
					Potatoes	5	2	0	1·4					
Total	141	0	38	35·3		71	3	19	18·0		186	2	14	46·

It will be seen from the above table that nearly one half the farm is in grass; that an additional fourth is under grasses in rotation; and that a little more than one third of the arable land is in Corn crops, and about half as much in Green crops.

The system of farming is based on the old four-course system, but the seeds are kept down for two or three years. Very little Wheat is grown; this year about 16 acres were sown in the spring, after Potatoes and Turnips. Oats are the largest Corn crop, as they are grown after Seeds, and also after Roots; about 80 acres were grown this year, and 45 acres of Barley.

The chief business of the Farm is breeding Sheep, fattening the Lambs; fattening bought-in hoggets on the roots, and fattening Cattle in winter. A flock of about 500 ewes is kept. These are bought in the autumn, and are chiefly half-breds (Cheviots and Leicesters), put to half-bred rams—but some Oxford Down tups, and a few Oxford Down ewes, have been tried with only partial success. This year 70 mountain Black-Faced ewes were bought in and put to Leicester tups. Judging from the numbers of lambs produced and reared this year, the farm must be well adapted for Sheep breeding. Young cattle are bought in spring, and early summer; some are fattened at grass, but the greater number are finished off in the winter and spring. The feeding is liberal, and the Turnips and Swedes have excellent feeding quality.

The management for the root crop is exceedingly good. The cultivation in one field, this year, may be cited. The land was winter ploughed 8 to 10 inches deep—cross ploughed—harrowed down and scrubbed, ridged, manured, closed in, and sown. The manure applied was 10–12 large cartloads of farmyard-manure,

and 6 cwt. of bone meal, dissolved bones, superphosphate, kainit, and Manchester dried sewage manure mixed together. In another case of stronger land there had been one ploughing, followed by three grubbings—the land was then "raised" or ridged—then scuffled between the ridges, and manured as before. In a third field a portion had been manured with farmyard dung, before the first ploughing, and at the time of sowing 15 cwt. of basic slag had been applied. In another portion of the same field 7 cwt. of Webb's turnip manure, and 7 cwt. of Hatfield's manure, were on trial side by side. About 60 acres of the old grass, and 20 acres of seeds are mown. The old grass is cleared early, and the whole of the land intended for hay has a top dressing of 6 cwt. superphosphate, 1 cwt. nitrate of soda, and 1 cwt. kainit. The mixture of seeds sown is

2 lbs. Cocksfoot.	1 peck Perennial Rye-grass.
2 ,, Timothy.	
2 ,, Meadow fescue.	2 ,, Improved Italian Rye-grass.
1 ,, Rib grass.	
2 ,, Alsike.	
4 ,, Red clover.	
2 ,, White clover.	
15 lbs.	3 pecks.

The first visit of the Judges was made on the 14th of December. The ground was frozen hard, and work on the land was suspended. We inspected the stock and the premises, and the different fields of roots. At that time there were on the farm—

Horses:—9 working horses.

Cattle:—28 feeding steers in folds and byres.
22 feeding heifers in byres.
2 feeding cows in byres.
2 cows with 2 big calves in boxes.
5 young steers on grass by day and in fold at night.
11 heifers on grass by day and in fold at night.
22 steers in park.
4 milch cows (including one belonging to the shepherd).

Total 96 [9 fat cattle had been sold within the three preceding weeks.]

Sheep:—417 half-bred ewes.
70 black-faced ewes.
9 tups.
26 feeding sheep on turnips.
328 hoggets.

Total 850

The horses were getting chopped hay, and 9 to 10 stones of good Oats a week. The working hours are in winter from daylight to 12, with $\frac{1}{4}$ hour for breakfast in the field—they are then fed for $1\frac{1}{4}$ hour in the stable, and work until dark. They were useful horses in good condition.

The feeding Cattle had been bought in the spring—they had been receiving cake on the grass since 1st of August, and they were then getting 8 to 10 lbs. of cake and meal, chopped hay, and a few turnips. The cows had moss litter laid behind them to absorb the urine. The Cattle were chiefly Irish, and were in no way particularly noticeable. They appeared to be well tended, and in a thriving condition. The Sheep were level in character. The ewes were on grass, and the hoggets were folded on turnips, and were in good condition. The Swedes and Turnips were very good in quality and quantity; some were clamped in large square heaps, about 4 feet deep; they had a little grass and fern and leaves thrown on the top, and would receive no other protection.

Our second visit was made on the 24th of May, and was more minute than the former one could be. The following account of the Cattle and Sheep was then furnished to us:

The annual valuation stock-taking, which had been made on the 14th of May, was put before us, and the sales and purchases since that date were abstracted from the account-books, which are regularly kept:—

Cattle:—

14th May.	24th May.
3 milch cows	3
1 heifer in-milk	1
1 calf at foot	1
48 feeding cattle in byres, boxes, or yards − 15 sold	33
42 grazing cattle + 34 bought	76
Total 95	Total 114

Sheep:—

384 half-bred ewes, 66 black-faced ewes − 15 sold	435
664 lambs, 60 ,, − 27 sold	697
135 hoggets − 15 sold	120
Half-bred ewe hoggets bought in	61
Total 1309	Total 1313

The Cattle were rather uneven in character. The Sheep stock showed well, and the record of lambs reared, and the account of sales, were remarkably good. From 487 ewes put to the ram 764 lambs had been reared. But this account is unfavourable

to the half-breds, as 10 out of 70 Scotch sheep had proved barren, and from the 417 half-bred ewes 704 lambs had been reared—which is at the rate of about 169 lambs for 100 ewes put to the ram. Only two ewes had been lost in lambing. Forty fat lambs had been sold, and many more were ready, or nearly ready, for the butcher. The ewes were getting about $\frac{3}{4}$ of a lb. of a mixture of linseed and decorticated and undecorticated cotton-cakes and maize. Those from which the lambs had been weaned were fat. We saw on one field 20 lambs, the produce of 10 ewes, which had been sold to a butcher on the previous day at 37*s.* each. More than 200 of the 328 hoggets seen at turnips on our former visit had gone away fat. The feeding Cattle still remaining in the yards and byres were getting 6 to 8 lbs. of mixed cake (linseed, decorticated, and undecorticated cotton), 40 lbs. of mangolds, and a supply of hay and oat straw cut into chaff. The two running suckers which we had seen on the 14th of December with their dams had been sold by weight: one of them 11 months old had weighed 46 stones, and the other, which was a little younger, 40 stones.

The swede turnips were above ground, and the land had been brought into splendid condition for them. The remainder of the root land had been cleaned, and was ready for sowing the common turnips. Field No. 20, of fifteen acres, had, after Potatoes and Turnips, been sown with Wheat in the end of February; it had not a very promising appearance. It was "square-head" wheat, and 2 bushels an acre had been sown. This kind of Wheat would generally not be chosen for late or spring sowing, and many farmers think that 2 bushels is a light seeding even in the month of October, as it tillers less than many varieties. The Oats and Barley were rather thin and patchy crops.

Our final visit was made on the 5th July, after a prolonged spell of dry weather and some scorching days. This farm had been a good deal burnt up, and Mr. Lyall's chance of the first prize was no doubt seriously diminished by the character of the present season. A good deal of the grass was dried up—the hay crops were very light, and the Corn had suffered.

The head of stock was then as follows :—

124 *Cattle* of various ages; a few of these still feeding in the fold-yards, but the great majority on old grass and seeds.

1070 *Sheep* :—

300 half-bred ewes.
55 black-faced ewes.
510 lambs.
205 hoggets.

Since our previous visit the following sales had been made:—

80 ewes, averaging about 43*s*.
80 shearlings, averaging about 45*s*.
210 lambs, averaging about 34*s*.
47 fat cattle, at about 18*l*. each.

A large number of the ewes and lambs were fat, and so were most of the Cattle in the yards—some yearlings among them weighing about 36 stones. They were then having boiled meal mixed with chopped hay, and 4 lbs. of mixed cake. The meal was composed of decorticated cotton-cake, mixed with Paisley meal, which is made from Indian corn, the starch of which has been extracted. This meal costs 4*l*. a ton. These young cattle had been bought on the 12th May at 8*l*. each. If they realised 7*s*. a stone, which they were perhaps worth on that day, they would pay 12*s*. 6*d*. a week for keeping, which would be fairly remunerative. Among the recent introductions to the farm had been some polled Galloway cattle, bought at 9*l*. 10*s*. each. Notwithstanding the scorched appearance of the fields, the stock all looked remarkably well. The Corn was light—some of it very indifferent, and not thoroughly clean. The Wheat was thin. Two fields of Oats were decidedly light. Another, which was after roots, though stronger in growth, was uneven, as was a field of Barley adjoining it. The other field of Barley on the highest part of the farm was rather light, but clean and promising. Mangolds were only half a crop, and had been filled up with Swedes. Swedes were all good. The common Turnips were in a critical condition. Potatoes (Champions and Magnum Bonums) looked very fine.

The fences of the farm generally had apparently been neglected at some former period, and, like most of those in the neighbourhood, they had numberless gaps and very little really healthy growing wood. This is no doubt partly owing to the smoke and the fumes of the collieries, coke ovens and manufactories, but the occasional appearance of a really good quick-hedge shows that it is not impossible to rear and maintain them. The injury to the fences was probably done before Mr. Lyall's occupation, and all the gaps are now fenced with dead rails.

Mr. Lyall, who keeps very good accounts, furnished a statement of his receipts and expenditure under different heads for the past ten years. From this statement the account printed on page 624, and showing the average amount received and spent, has been compiled. And since it happens that the last two years'

accounts show a profit greater than the average, they are given in detail for the purpose of comparison. (See page 625.) *

These accounts are most interesting and instructive. A few comments upon them may be permitted. The amount paid to labourers has been almost exactly 1*l.* an acre, but as will be seen hereafter, the entire cost of labour is not covered by this sum. The expenditure on artificial manure and cake has averaged nearly 25*s.* an acre. The receipts for Cattle, Sheep and Pigs, with Dairy produce, amount to 2851*l.* a year after deducting purchases, or 3*l.* 15*s.* 4*d.* an acre over the whole farm. During the last two years they have averaged 4*l.* 8*s.* 6*d.* an acre. The receipts for Poultry figure as a considerable item in the accounts of recent years. In these ten years' accounts we have the materials for estimating the average value per acre of the produce of the farm from its own resources:—

	£	£
The gross receipts are		6747·8
The purchases of manure are	259·2	
" " food "	758·7	
" " keeping "	23·8	
†The deterioration in value of stock	137·7	
	1179·4	
The purchase of live-stock	2898·3	
		4077·7
Balance		£2670·1

This, on 757 acres, gives for every acre a sum of 3*l.* 10*s.* 6*d.* to be divided amongst the landlord, the farmer, the labourer and the tradesman. We have already seen that the labourer has got more than 1*l.* of this. It appears that the farmer got only 12*s.* 3*d.* of it.

It is certainly curious to find the profits of the last year so far above the average, notwithstanding the low prices of meat

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* An explanation of the third column of figures in the table on page 624 is perhaps required. The question is frequently asked what proportion of the receipts of the farmer is expended in rent, labour, &c. Now in order to bring breeding and fattening farms to a level, it is necessary to deduct the purchases of live-stock from the sales—otherwise a farm which is self-maintained will show a much smaller total of receipts, and consequently a larger proportionate expenditure. In this case, if gross receipts be taken, rent, rates, &c., only represent 17 per cent. instead of the traditional one-third, or if gross expenditure be taken, gross rent is 18 per cent. of it. A breeding farm for which no live-stock was purchased might produce as much meat, but the receipts would only appear as 3849*l.*, and the rental would in that case absorb nearly 30 per cent. of the receipts. By deducting the cost of purchased stock from the value of stock sold, we arrive at the value of that produced on the farm.

† This may, however, include depreciation in value of dead stock.

PEEPY FARM.—ABSTRACT ACCOUNT showing the AVERAGE AMOUNT RECEIVED and EXPENDED under various HEADS for the TEN YEARS ending 13 MAY, 1887.

EXPENDITURE.	£	£	Percentage of Receipts. Per cent.
Rent	1006·8		
Rates	124·7		
Taxes and Insurance	15·4	1146·9	29·80
Labourers' wages	..	764·7	19·86
Manure and Litter—			
Artificial manures	197·8		
Dung	12·0		
Lime and Gas Lime	43·0		
Moss Litter	6·4	259·2	6·73
Purchased Food:—			
Cake	737·2		
Corn	21·5	758·7	19·70
Miscellaneous Expenditure—			
Seeds and Seed Corn	78·0		
Keeping bought	23·8		
Tradesmen	112·0		
Implements	35·5		
Sundries	68·9	318·2	8·27
		3247·7	84·36
Live Stock bought—			
Horses	48·5		
Cattle	1293·2		
Sheep	1550·6		
Pigs	6·0	2898·3	
Difference in value of Stock in 1887 as compared with 1877	..	137·7	3·58
		6283·7	
Profit		464·1	12·06

RECEIPTS.	£	£	Percentage of Receipts. Per cent.
Corn	840·9		
Hay and Straw	23·5		
Potatoes and Turnips	44·1	908·5	23·6
Live Stock—			
Horses	21·9		
Cattle	2351·3		
Sheep	3291·7		
Pigs	26·2	5691·1	72·5*
Dairy Produce	..	58·5	1·5
Poultry	..	37·7	1·0
Sundries	..	52·0	1·4
		6747·8	100·0

If the purchases of Live-stock be deducted from the receipts under that head, the total receipts will be 3849·5*l.* as against an expenditure of 3247·7*l.*, leaving a balance of 464·1*l.*

For the purpose of calculating the percentage of expenditure and receipt 3849·5*l.* is taken as 100.

* Calculated on 2792·8*l.*, the balance after deducting 2898·3*l.* from 5691·1*l.*

Expenditure.	Year ending 13 May, 1886. £ s. d.	£ s. d.	Year ending 13 May, 1887. £ s. d.	£ s. d.
Rent	926 12 9	..	812 12 9	
Rates	102 11 0	..	98 12 5	
Taxes and Insurance ..	19 4 1	1048 7 10	19 0 10	930 6 0
Labourers' Wages ..	..	759 13 3	..	795 3 2
Manure, &c., Artificial—	176 10 7	..	136 16 6	
Lime and Gas Lime	16 6 7	..	19 6 10	
Moss Litter	21 7 3	214 4 5	22 14 2	178 17 6
Cake	815 0 0	..	752 1 9	
Corn for Horses	101 6 1	946 6 1	36 2 5	788 4 2
Seeds and Seed-corn ..	63 2 4		103 7 0	
Hay and Grass bought	68 12 6	..	6 0 0	
Tradesmen	145 7 9	..	125 14 1	
Implements	75 3 8	..	13 2 0	
Sundries	81 1 7	433 7 10	93 14 2	311 17 3
		3101 19 5		3031 8 1
Live-stock bought—				
Horses	112 3 0			
Cattle	1380 17 9	..	1051 8 4	
Sheep	1736 9 5	..	1430 5 9	
Pigs	..	3229 10 2	4 17 6	2186 11 7
		6631 9 7		5520 19 8
Valuation, May, 1885 ..	5034 0 0			
„ „ 1885 ..	4701 2 6			
Difference	..	332 17 6	..	597 2 6
		6964 7 1	..	6118 2 2
Balance Profit	..	459 3 4	..	744 1 0
		7423 10 5	..	6862 3 2

Receipts.	Year ending 13 May, 1886. £ s. d.	£ s. d.	Year ending 13 May, 1887. £ s. d.	£ s. d.
Corn	702 17 10	..	713 8 6	
Hay and Straw ..	14 8 6	..	8 11 3	
Potatoes and Turnips	75 0 3	792 6 7	60 3 2	782 2 11
Live-stock—				
Horses	53 17 6			
Cattle	2149 9 10	..	2359 18 3	
Sheep	3895 16 9	..	3507 17 9	
Pigs	33 8 10	6432 12 11	5 10 0	5873 6 0
Dairy Produce ..	..	53 11 6	..	51 15 1
Poultry	..	112 11 4	..	116 18 5
Sundries	..	32 8 1	..	38 0 9
		7423 10 5		6862 3 2

and the fall in the value of stock. It is a proof of the energy and perseverance of Mr. Lyall that he should have surmounted those difficulties. His profit is after all not a large one considering the amount of capital employed.

The following particulars of the labourers regularly employed on the farm, their wages and allowances, were given :—

Employment.	Weekly Wages.	Extra Money.	Allowances, Perquisites, and Payments in kind.
	s. *d.*	£ *s.* *d.*	
1 Steward	30 0	..	House and small garden.
2 Shepherd	..	..	House and garden; keeping for 10 ewes and their lambs; 5 hoggets and a cow; 63 stones of oatmeal; 6 bushels of wheat; 24 bushels of barley, and 6 bushels of peas; 1800 yards (running) of potatoes (about 50 perches) seed provided.
3 Under Shepherd	18 0	1 0 0 Harvest.	Keeping for 2 ewes.
4 Head Ploughman	19 0	1 0 0	20*s.* a-week in harvest; 80 stones of potatoes; 4 bushels of Barley, house, &c.
5 Byreman	17 0	..	House and garden; 80 stones of potatoes.
6 Stacker	17 6	1 0 0	Ditto ditto ditto.
7 Horseman ..	16 0	1 0 0	Ditto ditto ditto.
8 Hedger	17 0	1 0 0	Ditto ditto ditto.
9 Groom	18 0	..	Ditto ditto ditto.
10 Horseman	16 0	..	Single.

The householders all find a woman worker, at 1*s.* 3*d.* a day, with 35*s.* for harvest. The wages are very much higher than in the East and South of England, but if the value of all the allowances be added to the sum actually paid in wages, the average cost per acre will not exceed 23*s.* 6*d.* Thus :—8 cottages and gardens, rent free, 5*l.* each, 40*l.*; keeping of sheep and cow, 30*l.*; potatoes, 14*l.*; meal and corn, 8*l.*; total, 92*l.* Wages, 1887 :—795*l.* + 92*l.* = 887*l.* on 757 acres = 23*s.* 5*d.* per acre.

Mr. Lyall strongly recommended to the Judges as deserving a certificate of merit, his steward, Ralph Milburn, who has been employed in that capacity on the Peepy Farm for 35 years, and under three different masters; and the Judges had much pleasure in doing so, as there was everywhere abundant evidence that Mr. Lyall's efforts were ably supplemented by those of his manager.

The Judges were unanimous in awarding the second prize to Mr. Lyall, whose farm exhibits considerable skill and energy successfully applied.

Among the farms in this class which did not receive a prize there is one which deserves something more than a passing notice.

Mr. Weightman's Farm, Hall Farm, Silksworth, Sunderland.

Highly Commended and Reserve Number in Class I.

This is a farm of 384 acres, of which 271 are arable, and 113 pasture. It lies about three miles to the south-west of Sunderland, and about one mile from the sea. It belongs to Mr. W. R. Robinson, and is held from year to year at a rent of 795*l.*, in addition to tithe rent-charge of about 65*l.*, and rates 65*l.* This is nearly 45*s.* an acre, exclusive of rates. The greater portion of the farm has been in Mr. Weightman's occupation thirteen years; but part of the farm was added to it six years ago. The land is for the most part very strong, but there are patches of gravel and sand.

There are two sets of buildings on the farm—one of these, with the farm-house adjoining, is completely new. The house is very commodious. A number of farm servants are lodged and boarded in the house, and the arrangements for their accommodation are exceptionally good.

The buildings also are new and well arranged, particularly the cow byres, in which a central gangway runs behind 2 rows of stalls. The root house and mixing room stand between two of these byres. The byres have cement floors, and they are kept thoroughly clean. All the drainage of the buildings is carried to a tank, and the liquid manure is pumped up and applied to the grass land or the seeds. In addition to the new buildings erected by the landlord, Mr. Weightman has put up implement sheds at his own cost. He has also grubbed about two miles of fences, and made hard roads to the outlying fields.

Mr. Weightman sells Wheat, Barley, and Oats, Turnips and Potatoes, green forage crops, Hay from permanent and rotation grasses, and Straw. He also sells a large quantity of Milk and some Meat. The situation of the farm enables him to dispose of all descriptions of produce, to get any number of labourers, male or female, when work is pressing, and to maintain the fertility of the land by large importations of not very costly manure.

The prices which we noted during our visits were milk 7*d.* to 8*d.* a gallon, the buyer finding churns, scouring them, and fetching the milk: Swede turnips 18*s.* a ton in winter, and 30*s.* in the spring: Hay 87*s.* a ton for second-year seeds of very moderate quality, the buyer cutting, trussing, and carrying

it away: Seeds 12*l.* to 14*l.* an acre, the buyer cutting the crop and carting it. On the other hand, long manure from the town is delivered close to the farm at 4*s.* 6*d.* a truck, which contains about 4 tons. In the 16 months preceding our May visit, at least 1600 tons had been brought on to the farm in this way, besides what is carried from the town by drays which are constantly delivering produce there. A colliery village lies on the edge of the farm, and the contents of the middens are regularly removed to this farm, the only cost being that of labour and carting. In addition to all the long manure and ash refuse thus collected, Mr. Weightman spends 200*l.* a year in artificial manures, exclusive of nitrate of soda.

About half the grass land is mown every year. This land is all heavily manured; frequently long manure is applied immediately after the hay is carted.

On the arable land no particular rotation of crops appears to be adhered to. About one-third is in corn, two-fifths in green crops, and one-fourth in seeds, as will appear from the following table, showing the cropping of 1886–87:—

Corn Crops.			Green Crops.			Grasses in Rotation.		
	1886.	1887.		1886.	1887.		1886.	1887.
	acres.	acres.		acres.	acres.		acres.	acres.
Wheat ..	27½	28½	Turnips and Swedes ..	59	52	Seeds 1st yr.		41½
Barley ..	34½	46½	Potatoes ..	64	46¼	" 2nd yr.	55¼	21½
Oats	30¼	19¾	Tares ..	..	4	" 3rd yr.		10¾
	92¼	94¾		123	102¼		55¼	73¾

The order in which these crops are grown is not fixed. This year Potatoes follow Swedes in one field, Clover in another, and Barley in a third, while in another field Swedes are found in succession to Potatoes. The land varies much in quality and character, and the crops are varied according to circumstances. The crops which are most successfully grown are Potatoes and Seeds. For the former the land is heavily manured with thirty loads of ash manure, and a heavy dressing of the best farmyard manure in addition; when the supply of home-made manure is not sufficient, 7 to 8 cwt. of special artificial manure are applied. The Seeds of the first year are either watered with liquid manure or top-dressed with 2 cwt. of nitrate of soda. A large portion of the first year's crop is generally sold to collieries, cab-proprietors, cow-keepers, &c. The buyer cuts two crops green, and the seller has no expenses. This year 25½ acres had been

sold for 324*l.*, or nearly 12*l.* 15*s.* an acre; there are few crops as profitable as this. It need not be said that they were magnificent crops of seeds. In the second year the seeds are mown twice, and they sometimes remain for a third year.

Sheep are not regularly kept; a few are bought in the autumn to eat up any grass which may remain. Horses (hunters) are taken in to graze in summer at 6*s.* 6*d.* to 7*s.* a week. But the production and sale of milk is the most important business of the farm. From 24 to 32 cows are milked, and the milk sold by contract to a buyer who fetches it away. The sales of milk from January 1 to July 1 amounted to 344*l.* 16*s.* 3*d.* Cows in high condition are purchased, and they are kept well and sold fat when out of profit. They are milked at 5 A.M. and 12 noon. When they are being milked, they get a pail full of "crowdy," mixed grains, cotton-cake, and meal. In winter their food is cut-turnips three times a day, hay twice, and they are suppered with oat-straw.

The management and economy of labour is remarkably good. Six men-servants live in the house: they are engaged for six months (November 23 to May 13). Their wages, 1886–87, were—one at 10*l.* 10*s.*, one at 9*l.* 10*s.*, three at 7*l.*, and one at 5*l.* They rise at 4.30 A.M., and feed their horses; they then milk, two women-servants assisting them. The byreman feeds the cows while the milking is in progress. As soon as this is over —6 A.M.—the byres are cleaned, and a feed of turnips is given by the lads, while the men attend to the horses and clean the stable.

Breakfast is at 6.30, and consists of coffee, bread and butter, and sometimes meat. The teams are yoked at 7 A.M., and each man takes into the field with him a bottle of milk and a piece of bread. At 12.0 noon the horses come into the stable. Dinner is at 12.15, and is a good square meal of boiled or roast beef, with potatoes and other vegetables, and enormous puddings and pies. However, it lasts less than half an hour, and the men turn out to milk. This must be finished before 1.30. The teams go out again at 2, and work up to 5 o'clock, when the horses and cows have to be fed, and the byres and stables cleaned up. Tea is served at 5.30, with bread and butter. Work is finished at about 7.30, and between 8 and 9 the men get a draught of new milk and a piece of bread.

The master and mistress, as a rule, take their meals with the servants, and superintend the milking. The men, though hard worked, are well-cared for: the rooms in which they live and sleep are as clean and comfortable as any one could wish for, and the provision was of the best quality. Whether house servants in the East of England would be satisfied with the

dietary may be doubted. Mr. and Mrs. Weightman are total abstainers, and no beer allowances are made in the house or on the farm.

Mr. Weightman is not much of an accountant, but he was able to give very satisfactory proofs that his business had been a profitable one. Four years ago he had a great blow, which might have crushed a less enterprising man. Pleuro-pneumonia broke out in his herd, and his cows were all slaughtered. For some time he could sell neither hay nor roots; and of course he could bring no fresh cattle on the premises.

The farm is an excellent example of opportunities recognised and seized upon. At the same time it must be admitted that very few enjoy such exceptional advantages of position as Mr. Weightman.

Messrs. Angus' Farm, Bearl, Stocksfield.

Highly Commended in Class I.

The farm entered by Messrs. Angus in Class I., and highly commended by the Judges, has for more than thirty years been distinguished for its Shorthorn herd. The father of the present occupiers took the farm at Bearl in 1851, and brought some Shorthorns from Hindley. They were descended from the herd of Mr. George Angus, of Styford, and traced back to Collings' "Son of Hubback" (319). Bulls from the herds of Messrs. Crofton, Denham, Gilbert Wood, and from Warlaby and Killerby have been used; and latterly "Ben Brace" (20,524) of the Killerby "Bracelet" tribe, "Richmond" (37,340), "Foreign Viceroy" (41,571), and "Village Chief" (52,304), of Mr. Torr's "Riby," "Flower" and "Village" tribes. "Hiawatha" (48,027), bred by Mr. Gordon, Arabella, Invergordon, is now in service. The aim of Messrs. Angus has been to produce young bulls which have been sold at from twelve to eighteen months old.

Unfortunately in the summer and autumn of 1885 the herd suffered severely from abortion. The best of the cows were sold off fat, and the herd is at least for a time under a cloud, though the plague is stayed, and the young stock are breeding.

On this farm it may be noted that the Judges saw the finest piece of swedes that came under their observation. In a field where the soil is of pretty even quality, some half-dozen varieties of seed had been sown side by side under the same conditions. It will be interesting if Mr. Michael Angus will make public the result of his experiment.

Mr. Fenwick Wilson's Farm, Marden, Whitley.

First Prize in Class II.

This farm, which contains 220 acres, belongs to His Grace the Duke of Northumberland. It is held on a yearly tenancy, and, unlike most of the farms in Northumberland, the entry is on the 25th of March. This appears to be the usual custom on this estate. The incomer pays for the seed and labour on Corn crops sown, and thus has a much easier entry than is usual in this county.

The rent is 630*l.* a year, from which however 10 per cent. has been allowed as an abatement. Mr. Wilson has only been in occupation two years, so that it cannot be said that there has been no re-adjustment of rent. The average rent as abated is 51*s.* 9*d.* an acre. The rates amount to 93*l.* a year, or more, so that the gross rent of the farm is even now 60*s.* an acre.

The farm is situate about a mile to the north of Tynemouth, and $\frac{1}{4}$ mile west of the Whitley Station on the Blyth and Tyne Railway, and only a few hundred yards from the sea. The farm is cut in two by a disused line of railway, and a portion of it is severed by the present line.

The homestead is placed at the extreme northern edge of the farm, but it is near the railway and by the side of the road. The house is good, the garden excellent. The buildings are also good and sufficient for the requirements of the farm. The byre is capable of accommodating 14 cows, and when we saw it filled with stock, it was as clean as such a place could be. The stacks and stack-yard were as neat as anything we saw, and that is a high commendation, as the neatness of the stack-yards was everywhere noticeable. There are 3 excellent cottages on the farm close to the homestead. These have upper floors and none of the defects noted in some other cases.

The soil of the farm is for the most part a strong clay, but its character is very much modified by the heavy dressings of town manure and town refuse, which are rendered possible by the close proximity of a large town.

The farm has been so much cut up by the two lines of railway, and the fences have been so much altered that it is difficult to distinguish them on the map supplied to the Judges. The schedule attached to the map gives the following quantities :—

	A.	R.	P.
Arable	165	3	31
Grass	50	3	14
Buildings, gardens, ponds, &c.	3	1	28
Total	220	1	33

Mr. Wilson gave the following particulars as to his crops in the present year:—

Corn Crops	Wheat	37	3	39				
	Barley	7	3	18				
	Oats	29	1	33				
						75	1	0
Green Crops	Turnips	24	0	13				
	Potatoes	25	2	19				
	Tares	2	0	0				
						51	2	32
	Clover					32	0	0
	Arable					158	3	32
Grass	Meadow for hay	30	3	24				
	Pasture	19	3	30				
						50	3	14
						209	3	6

This leaves about $7\frac{1}{4}$ acres unaccounted for.

Taking the statement as it is, it shows about one quarter of the arable land in Wheat (a circumstance without a parallel in the farms exhibited), and another fourth in Oats and Barley.

The business presents a great contrast to that of the two prize farms in Class 1, though it very much resembles that of Mr. Weightman's farm (Highly Commended, Class 1). Milk is perhaps the prime object of Mr. Wilson, but he also fattens Cattle, grows a considerable quantity of Corn, and sells Potatoes, Turnips, Hay, Straw, green Clover, and forage.

Tynemouth and the watering-place of Cullercoats are closely adjacent, and these and other places in the neighbourhood offer excellent markets for all these kinds of produce. The milk is nearly all retailed to private customers at 4*d.* a quart. A boy takes the milk round with a pony and cart, and collects the money in payment monthly. For the purpose of keeping up a supply equal to the demand, cows in high condition are bought as required. They are kept in an improving condition, and sold off fat when they no longer give a sufficient supply of milk. In winter the cows have turnips three times a day, half a bushel of grain or bran in two feeds, long hay and oat-straw. In summer they go out to grass and are brought into the byres in the evening, when they get green clover or tares. A few calves are reared, and young steers are kept to make manure. When grass in the autumn is abundant and is not required for the stock of the farm, sheep are taken in. A good deal of Hay and Straw is sold, and this is not surprising when the value is considered. At the second visit of the Judges, Mr. Wilson said he

could make 42*s.* per load of 12 thraves,* which is about 72*s.* 6*d.* per ton.

The fertility of the farm is maintained by heavy applications of town manure and scavengers' refuse. The Corporation of Tynemouth pay rent for a small piece of ground on the farm, and here they deposit large heaps of refuse, including that from fish-curing establishments. All this has to be cleared out of the town and got rid of, and Mr. Wilson pays nothing for it. The scavengers are so accommodating that they frequently distribute the manure on the land where they are directed to place it. In addition to this manure, Mr. Wilson brings home as back-carriage large quantities of stable manure. These are not the only advantages of the situation. A water works company has a main through the farm, and gives a free supply of water for the easement. A cricket club hires a bit of the grass and pays a good rent for it, while Mr. Wilson has the grazing. Of course all these advantages are paid for in the rent and the rates, which are stiff.

The proposed system of farming † is this :—

1st year, turnips and swedes.
2nd year, wheat.
3rd and 4th years, seeds.
5th year, oats or potatoes.
6th year, potatoes or wheat.
7th year, wheat or barley.
8th year, barley.

The climate is rather favourable for the growth of Wheat, and the straw is valuable. It is sown after Potatoes and Turnips. That after turnips is sown with seeds, the usual mixture being 2 bushels of rye grass ($\frac{2}{3}$ Perennial, and $\frac{1}{3}$ Italian), and 7 lbs. of mixed red and alsike clover. These seeds are mown twice in the first year, and once in the second. The land is then ploughed up and cleaned, and in the autumn ridged and mucked for Potatoes, or ploughed down for Oats. If Oats are taken, then Potatoes follow, and after Potatoes Wheat is taken, and is followed by Barley.

We visited this farm on the 20th of December. The ground was then covered with snow. The stock at that time was as follows :—

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* 1 thrave = 3 bottles of 36 lbs. each, or 108 lbs. 12 thraves = $92\frac{4}{7}$ stones.

† Mr. Wilson has not had much time to lay down a regular system adapted to the special capabilities of the farm and the situation, though as he was brought up on the adjoining farm he has not much to learn about this.

8 *Horses*:—8 working horses.

33 *Cattle*:—3 heifers fattening.
13 cows in-milk.
4 steers fattening in stalls.
9 young steers and heifer in open yard.
1 bull.
3 calves.

The *Horses* were particularly good and strong, chiefly Clydesdales.

Cattle were all good, and well attended to.

We inspected the Turnips, which were Green Globe. They were of very fair quality and size. We also saw some of the Potatoes. The crop of Reading Hero had been sold on the land at 17*l.* an acre. Champions had made 15*l.* an acre. The buyer had all the work to do, except ploughing them out. We walked over the farm, and we could distinguish some growing wheat, which we noticed the more, as it was the first we had seen in Northumberland, and it was to prove the only piece visible on the 16 farms we visited in December.

Our second visit was made on the 27th of May, when our previous good impressions were fully confirmed. Sixteen cows were then in milk, they were getting two feeds a day of pea-meal, and barley-meal mixed with bran or grains, long hay and potatoes. The Wheat crop, both autumn and spring sown, was excellent; Barley and Oats were promising, new seeds good, though rather deficient in clover. The Oats were sown after two years' seeds which had been mown three times. The land had been ploughed in the previous summer, and worked clean, ploughed again in November; grubbed in the spring with four horses, rolled, and drilled in the middle of March, with 3 bushels of White Tartars and Black Tartars. Another piece of Webb's Challenge Oats after turnips was remarkably good. Potatoes were set on land which had been ridged in autumn—split in the spring, and dressed with 16–20 tons per acre of good rotten manure. Early Bog (a sort of Regent), and Regents had been set. About half a ton of cut sets had been used per acre. The seed came from Scotland, and it is Mr. Wilson's practice to import a fresh stock every year. Another piece of potatoes on much stronger land had been set after seeds and oats. This land had been heavily manured with scavengers' manure, put on the land before the first ploughing, and a dressing of farmyard-manure had also been applied; the sorts planted here were Regents, Champions, and Reading Heroes. A third piece

after Barley had been 3 times ploughed, grubbed and cleaned, then manured with scavengers' manure—ridged and dressed with farmyard-dung.

About 17 acres of swedes had been sown, and the plants were up. This land had been winter ploughed—cross ploughed in spring, "scrubbed," grubbed and cleaned—then ploughed for the third time, ridged and mucked with farmyard-manure, and fish refuse which had been in a heap for some time previous. The remainder of the field—about 3 acres—was being worked, and was to be sown with yellow bullock turnips.

Our last visit was paid on the 4th of July. The autumn sown Wheat was very fine, the spring sown good, but coarse and dark in the flag. The Oats were very good, Swedes good, yellow bullock turnips fair, Barley fair. The Potatoes were not very vigorous; probably the drought had been too much for them. They were, however, thoroughly clean and might prove a good crop.

The stock was the same as on our last visit. A gelding, which was to be shown at the approaching Royal Show, and which got a first prize there, was among them. The cows and steers were in good condition.

Following the practice observed in describing farms in other classes, it will be desirable to give some particulars of the number and wages of the regular labourer.

The steward, who stacks, thatches, hedges, and does all the rough carpenter's work of the farm, has 20*s.* a week, house and garden rent free, 60 stones potatoes, and 20*s.* for coals. Four other men get 17*s.* to 19*s.* a week, and potatoes, and two of them a house and garden; the other two are unmarried and live with their father, the steward. None of these men are bound to find a woman worker, as there is no difficulty in getting any number of women from Tynemouth, at 1*s.* 3*d.* a day for ordinary work, and 2*s.* 3*d.* in harvest. The wife of one of the hinds assists the byre man in milking, for which she is paid 3*s.* a week.

The fences on this farm had been very much neglected, and they were being put in order by Mr. Wilson at considerable expense.

Mr. Wilson does not keep accounts in such a form as would enable him to present a proper balance-sheet. He does, however, keep books which record his sales and purchases. They afford some information, but not quite what one desires.

The following items were extracted from these accounts:—

Tynemouth Poor Rate	65 1 10	
Whitley Poor Rate	3 0 4	
		68 2 2
Tynemouth District Rate	22 4 0	
Whitley District Rate	2 18 8	
		25 2 8
		£93 4 10

In the preceding year these rates amounted to 99*l.* 19*s.* 6*d.* The cost of labour (partly estimated) is put at 414*l.* 12*s.*, or about 37*s.* 6*d.* an acre. Purchased manure cost 74*l.*; purchased food, chiefly grains, cost 147*l.*

On the receipt side, 10,220 galls. of milk brought 638*l.*, or 1*s.* 3*d.* a gallon after deducting commission on a portion of it sold to dealers when private customers did not require the full supply. Mr. Wilson estimates the whole cost of delivery, including the wages of the boy (8*s.* a week), at 60*l.* a year; this leaves 578*l.* as the value of the milk on the farm. Corn realized last year, 336*l.*; potatoes, 168*l.*; turnips, 70*l.* 10*s.*; clover sold to mow made 13*l.* an acre; straw, 120*l.*; hay, 290*l.*; casual rents, 55*l.*; sheep keeping, 39*l.* These figures show a considerable return, and we may suppose that cattle sales exceed the purchases, and that a stock of horses such as these will occasionally swell the receipts.

The Judges had not much difficulty in this Class in deciding upon the prize farm.

Mr. W. Davison's Farm, Pegswood Moor, near Morpeth.

Second Prize in Class II.

This farm, containing a little less than 200 acres, belongs to His Grace the Duke of Portland, and has been held by Mr. Davison from year to year for seven years past, at a rent of 250*l.*, from which there has been an abatement of late years of 10 per cent. The rates amount to 22*l.* 10*s.* The full rent is 23*s.* 9*d.*, or as abated, 23*s.* 3*d.*; and the rates are about 2*s.* 4*d.* an acre. The tenant, by agreement, is to cultivate on the five-course system, but in practice he does as he pleases. The landlord does all repairs.

The farm is about a mile to the N. E. of the town of Morpeth. A high road forms the eastern and northern boundary of the farm, and the homestead is placed near the centre of the farm at a distance of about 300 yards from the road. It includes a house occupied by the foreman, a good and substantial range of buildings arranged in the usual manner on three sides of a square court. The barn has an old-fashioned horse-

power threshing-machine which is never used. There are decent stables and shelter sheds, and a good granary. Outside of the old range is a byre for feeding, and a new feeding-house has been recently built at the joint cost of landlord and tenant. It is not an expensively constructed building, but it is a good type of a useful one constructed at a moderate cost. The sides are stud boarded and the roof is covered with pantiles. It contains 14 feeding boxes $10' \times 10'$, 7 on each side of a gangway which communicates with the root house, and along the gangway a truck, running on a tramway, brings the victuals for the stock. Over the root house is a cake granary, and over the feeding boxes in the roof is a straw barn, into which bundles of straw are taken when the corn is threshed. The floor of this loft is not continued to the outsides of the building, but a space of about 3 feet is left open, and through this the straw is thrown down into the boxes.

The soil of the farm is a light sandy loam : though it has all been drained, some portions of it were rather waterlogged on our first visit.

The area and cultivation of the farm are shown in the schedule on page 638.*

The summary shows that a little more than one-half the farm is pasture, and one-fifth is in artificial grasses.

It appears that this year only one-third of the arable land is Corn, one quarter is Roots, and two-fifth Seeds. In the previous year Corn was nearly one-half, but a piece of Seeds was left standing, and some Potatoes were planted after Turnips.

The ordinary method of farming is on the four-course system, Wheat being taken by preference after potatoes, as the climate and soil suit this crop better than Barley. Seeds are broken up for Oats as a rule, but sometimes Potatoes take the place of Oats.

A breeding flock of about 50 Border Leicester ewes is kept. Some lambs are sold fat; the best gimmers are kept for replenishing the flock, and the remainder are fattened upon roots. Young Cattle are bought and summered on grass or seeds, getting cake or meal, and they are fattened in the winter.

We visited this farm on the 16th of December, and were rather fortunate in the weather. There had been heavy rain in the morning after a sharp frost, but it had all cleared off when we arrived, and the air was keen. We walked all over the farm, and saw the roots. The mammoth swedes were rather

* There is a discrepancy between the figures of the entry certificate, which is only partially explained by the omission therefrom of 11 acres of pasture held previously to the hiring of the Pegswood Moor Farm.

PEGSWOOD MOOR FARM—CROPPING, 1887.

No.	Quantity.	Crop, 1887.	Remarks.
	Acres.		
1	6·544	Grass.	
2	4·318	Ditto.	
3	16·554	Ditto.	
4	13·335	Seeds	After wheat.
5	10·614	Potatoes, 4 acres; wheat, 6½ acres ..	After roots.
6	13·782	Wheat	After roots.
7, 8	22·609	Grass.	
9	12·068	Seeds	After barley.
10	20·456	Grass.	
11	1·506	Paddock	And homestead.
12	12·529	Grass.	
13	14·134	Seeds	Second year.
14	18·921	Potatoes, 2 acres; Swedes, 17 acres; and turnips, and mangolds	After oats.
15	11·423	Oats	After seeds.
16	15·419	Grass.	
	194·212		

SUMMARY.

	Acres.	Percentage.
Pasture	99·935	51·46
Arable	94·277	48·54
	194·212	100·00

ACREAGE and PROPORTIONATE EXTENT of each kind of CROP in 1887.

CORN CROPS.			GREEN CROPS.			GRASSES UNDER ROTATION.		
	Acreage.	Percentage of Arable Land.		Acreage.	Percentage of Arable Land.		Acreage.	Percentage of Arable Land.
	Acres.			Acres.			Acres.	
Wheat	20·396	21·63	Turnips and Swedes ..	16·421	17·42	Seeds	39·537	41·94
Oats ..	11·423	12·22	Mangolds ..	·500	·53			
			Potatoes ..	6·000	6·36			
Total	31·819	33·75		22·921	24·31		39·357	41·94

coarse; Hybrid, yellow, small; Swedes, fair; Green Globe, very fine. We inspected the buildings, and found the Cattle in very comfortable quarters. They were getting about 9 lbs. of mixed cake and meal; turnips three times a day (about 6 stones), and hay.

The stock on the farm was then:—

7 *Horses*, viz.:—3 horses, working.
1 mare, working.
1 two-year-old, 1 yearling, 1 foal } all out of the same mare, which was then in the team.

The foal was by a Clydesdale horse, kept by the Duke of Portland for the use of his tenants, who pay nothing but a fee of 2*s*. 6*d*. to the groom:—

37 *Cattle*:—28 steers and heifers fattening in boxes and byres.
7 stirks.
2 calves.

135 *Sheep*:—50 ewes.
85 hoggets.

2 *Pigs*:— 2 Yorkshire white sows.

The Horses were very good. The cattle, all bought in, were not remarkable. The ewes were of fair quality, and a good ram, from Mr. Fender of Berwickshire, was with them. The hoggets were on grass, and were getting some roots and corn. The two sows were excellent. Mr. Davison was experimenting with a silo in a corner of his buildings. Last year he had excavated the ground about 3 feet below the surface, but the water got in and spoiled the silage. This year he had filled up the hole to within 6 inches of the surface, and cemented the floor and sides. The size of the chamber was 14 × 9 × 10. It had been filled with a second cut of clover at two different periods about three weeks apart. It was trampled down by four or five women, and pressed by a lever, assisted by some heavy stones. We saw good samples of potatoes—Regents, Champions, Reading Heroes, and Magnum Bonums. Mr. Davison considered the Regent the best quality, and the Champion next, while the Reading Hero was the most productive. About half the Regents and Champions had been sold to people who came and dug them, paying 1*d*. per running yard, or 17*d*. for 20 yards.*

A crop of Wheat in the stack was estimated by Mr. Davison at 60 bushels per acre. It was the variety called Club wheat,

* This would be at the rate of 20*l*. to 24*l*. an acre if the rows were 30 inches apart.

and the seed had come from Norfolk. He considers an average crop to be from 40 to 50 bushels, and he says he can grow as many bushels per acre Wheat as he can of Barley.

The hired men on the farm are the steward and the hind. Their wages are 18*s*. and 16*s*. a week respectively. They have house and garden rent free, and 80 stones of potatoes. They find five women at 1*s*. 3*d*. a day, with 2*s*. 6*d*. in harvest.

Our second visit was made on the 26th of May, when we inspected all the farm. There were then on it the same horses as before, with a foal by the Duke's horse, out of the mare which had already a yearling, a two-year-old, and a three-year-old on the farm. She was now at regular work, and suckled the foal when brought home.

There were 26 *Cattle*, viz.:—2 steers, fat in byre.
6 steers, in grass.
5 stirks.
12 heifers.
1 cow.

And 169 *Sheep*, viz.:—42 ewes.
74 lambs.
3 barren ewes.
50 hoggets.

The 6 steers had run out all winter, getting some silage (which had turned out well) and straw; and when the silage was finished, some barley-meal. They were in good condition. The heifers and cow were on old grass. The ewes had begun lambing on the 8th March, and 4 out of 50 had died, which is a rather heavy percentage of loss. The lambs did not look very healthy; they evidently wanted a change. The hoggets were small, and not quite as good as we expected: they were the remnant of an original lot of 90. The swede turnips, and about half an acre of mangolds, had been put in, and were just appearing; and the land for turnips was being worked. The Wheat and Oats were not very promising. The old grass had some of it been dressed with 4 cwt. of superphosphate to the acre, but it was rather bare. The seeds were remarkably good.

The last visit was made on the 4th of July. The stock was much the same in number as before; 17 steers and 18 heifers were grazing. The ewes, lambs, and hoggets all looked as if they had suffered from the drought.

The Hay crops (Nos. 4 and 9, Seeds) had been mown, and had cut up very well. On No. 9 we counted 69 "pikes," which were estimated to contain half a ton each. No. 4 had received a spring top-dressing of one ton of superphosphate and 1 ton of bones to 13 acres. Taking the other arable fields in order, we noted—

No. 5. Four acres potatoes, Myatts, Dalmahoys, Champions. These were growing after a crop of turnips drawn off. The cultivation had been as follows:—Ploughed, scrubbed, grubbed, ridged, mucked with twenty loads of farmyard-manure to the acre. Crops very promising. Six acres of Wheat in the same field, sown in February, 2 bushels of square head to the acre; a poor crop, rather foul with annual weeds.

No. 6. Wheat after turnips, very thin. Much "runch" and other weeds.

No. 14. Roots after Oats. Two acres potatoes, half an acre mangold, 8 acres purple-top swedes removed; and about $8\frac{1}{2}$ acres yellow bullock, Fosterton hybrid, and green globe. 12 acres had been manured in the autumn with 40 loads (?) of good farmyard-manure to the acre, the rest was manured in the ridges. The land had been ploughed, then harrowed down, hand picked, then ploughed again, scrubbed, ridged, &c. 5 cwt. of dissolved bones had been supplied per acre.

No. 15. Oats. Short but thick—a fair crop.

The farm was neat and trim generally, the buildings and stackyard in excellent order. The fences were better than most and well attended to. Mr. Davison, with the assistance of his landlord, had made great improvements by straightening fences. He has also made a good road up to the buildings, and through the centre of the farm.

The farm is naturally a poor one, enriched by good cultivation and liberal manuring. A crop of 60 bushels of Wheat to the acre, or even 50 on poor land, is an indication of a good preparation for the crop.

Mr. Davison, who has other strings to his bow besides farming, keeps accounts in proper mercantile way, and he furnished a copy of his balance-sheet for 2 years. The items are not classified exactly as in other accounts presented, but the difference in form is not material.

This account presents a less favourable review of farming than the last which was discussed (p. 625), but it is thought desirable to print it, because it is always difficult to get hold of such accounts. Here is a farm managed on commercial principles, well equipped and well worked, and the average profit of two years is less than 30*l.* The capital employed cannot be less than 1200*l.*, and so the farmer gets $2\frac{1}{2}$ per cent. for his money. The labour bill on this farm, in which is included the hire of a threshing-machine, is only about 17*s.* 4*d.* an acre, the perquisites would not bring it up to more than 18*s.* It will be seen that in this case, as in others, meat is a far more important item in the account of receipts than corn.

The Judges, in awarding the second prize to Mr. Davison, recognised the general good management of his farm, the character of his stock, and the improvements which he has made, and of which he has not yet reaped the full benefit.

PEGSWOOD MOOR FARM, 194½ ACRES.

ABSTRACT ACCOUNT of RECEIPTS and EXPENDITURE for 2 years.

EXPENDITURE.

	Year ending 13 May, 1886. £ s. d.	£ s. d.	Year ending 13 May, 1887. £ s. d.	£ s. d.
Rent	225 0 0			
Rates and Taxes * ..	22 10 0			
		247 10 0		259 6 2
Labour	..	167 5 8		168 16 2
Food purchased—				
Cake	..	109 15 3		101 6 2
Manure—				
Artificial	23 15 0	..	52 1 6	
Loam, &c.	33 0 5			
		56 15 5	28 10 9	
Miscellaneous—				82 12 3
Seeds, Seed Corn, and Potatoes ..	33 8 10	..	33 0 8	
Hay and Straw ..	13 7 6	..	10 12 0	
Tradesmen and Incidental expenses	53 8 10			
		99 15 2	117 9 3	
				161 1 11
		681 11 6	..	
Live stock purchased	..	327 19 2	..	773 2 8
Depreciation in value of Stock in hand ..	..	61 12 2		448 10 4
Profit	..			61 18 8
		1071 2 10		
				1283 11 8

RECEIPTS.

	Year ending 13 May, 1886. £ s. d.	£ s. d.	Year ending 13 May, 1887. £ s. d.	£ s. d.
Corn	..	88 10 0	..	130 19 0
Live-stock	882 8 3	..	846 15 8	
Wool	24 9 0	..	19 6 0	
		906 17 3		866 1 8
Potatoes	..	55 9 8	..	98 11 10
Keeping	..	13 15 6	..	17 12 0
Sundries	..	2 16 0	..	9 14 0
		1067 8 5		1122 18 6
Increase in value of Stock in hand ..	..			160 13 2
Loss	..	3 14 5		
		1071 2 10		1283 11 8

Profit, 1887 ..	61 18 8
Loss, 1886 ..	3 14 5
Two years' profits	£58 14 3

Mr. George Drysdale's Farm, Great Ryle, Alnwick.

First Prize in Class III.

This farm, of about 900 acres, is the property of the Earl of Ravensworth, and has been for many years in the occupation of Mr. Drysdale, who holds under a twenty-one years' lease, from the 12th of May, 1870. By the conditions of this lease the tenant undertakes to repair and insure the buildings, to manage in a husbandlike manner, to cultivate on the four-course system, and not to sow two white straw crops in succession. At the conclusion of the lease the outgoing tenant is to "hain" one-eighth of the grass (excluding the hill) from the 25th of March; he is not to keep more than the usual number of stirks on the grass in the last six months, nor less than the usual quantity of cattle in the foldyards. The landlord enters on the lands for fallow on 1st December, and the tenant gets an away-going crop from one-half of the tillage lands coming in course for corn. The landlord is to lead this crop into the yard and to thresh it gratis.

The rent of the farm is under the lease 1160*l.*, but abatements of 10 and 15 per cent. have been made in recent years. There is a tithe rent-charge of 6*l.* a year, and the rates amount to about 70*l.* If the rent including tithe be apportioned on the quantities of arable pasture and hill given in the certificate of entry, probably the following relative prices will not be unfair: arable 35*s.*, pasture 45*s.*, hill 11*s.* 6*d.*

Great Ryle is a township in the parish of Whittingham. Mr. Drysdale's farm lies about 12 miles west of Alnwick and 8 miles north of Rothbury. Up to the present time these have been the nearest railway stations, but the new line of railway from Alnwick to Cornhill will give a nearer station and improve the means of communication with the outer world. The farm is an irregularly shaped figure, though entirely within a ring fence. On the south the river Aln is the boundary. From the river the farm runs for nearly $1\frac{1}{2}$ mile northwards. About half-way in this direction lies the homestead on a road that cuts the farm from east to west, and at this point the farm extends nearly $\frac{3}{4}$ of a mile in each direction. To the south of this road a very large proportion of the cultivated land lies, and the whole of the hill is on the northern side. The ground level at the river side is about 350 feet above the sea. Ascending from the river, the slope is at first very gradual, 50 ft. in 30 chains, or about 1 in 400, it then, from 400 ft.–500 ft., becomes rather steeper, 100 ft. in 18 chains, or 1 in 119. From the

500 ft. contour line to that of 600 is 12 chains, a rise of 1 in 79, and it is just on the verge of this line that the farm-house and a portion of the steading are placed, the remainder of the farm buildings being at a little distance on the other side of the road. At the back of the house rises Chubden Hill, the highest point, 916·6 ft., being about 25 chains to the N.E. of it.

The 600 contour line is practically the limit of cultivation, though the plough has been driven up to 700 ft. or above, but only about 120 acres lies above 500 feet. The farm is thus on the southern slope of a fairly lofty hill which defends and shelters it on the N.N.E. and N.W. Southwards the house looks over the greater part of the arable and pasture lands, the latter running down to the river.

The house is a good, roomy and substantial one. The buildings are not at all equal to the farm. Those on the farther side of the road are in a very dilapidated condition, and we understood that they were to be pulled down and a new range built. The position of this steading is fixed by the water supply. A little burn which comes down from the hill is dammed up and forms a pond, from which the water is led to a wheel which drives a threshing and winnowing machine, a chaff-cutter and a mill.

The barn stands on sloping ground, and the stackyard is on a level with the table of the threshing drum. At the back of the house are some more modern byres, stables, &c. There are 9 cottages on the farm, one of which is let off; the others accommodate a steward, shepherd, groom, blacksmith and four hinds. Those we entered contained one room on the ground floor, a pantry, one bed-room above, and a small landing open to the stairs, on which, however, a bedstead was placed. The cottagers have pig-styes and a comfortable byre for their cows, five of them having a cow of their own. The cottage gardens were in excellent order, one of the cottagers being a frequent prize-winner at local shows of vegetables.

The soil of the arable and pasture lands varies, some being light and stony, some sandy loam and some strong clay. The higher land is on whinstone, which is generally considered to have a fertile soil. A good deal of the stronger land on the lower side of the farm has been kept down in pasture for many years past, perhaps not laid down deliberately, and the tenant retains the power of breaking it up again; but, though classed as arable land, it is in fact pasture. This fact may explain the difficulty which there seems to be in making the quantities of the entry certificate and those of the maps agree.

The entry is:—

Arable	390	2	15
Pasture	136	3	16
Hill or Moor	423	3	19
	921	1	10

Taking off the quantities from the map supplied, there would appear to be at the present time:—

Arable	282	3	2
Pasture	212	3	5
Hill or Moor	405	3	3
Homestead Cottages, Gardens, &c.	8	3	0
	910	0	10

In this quantity of pasture are, however, included 117 acres which have been in grass for some years, but were arable when Mr. Drysdale entered the farm.

Of the 283 acres, which is all that is now practically under the plough, the cropping for the last two years has been as follows:—

	1886.		1887.	
	Acres.	Acres.	Acres.	Acres.
Barley	59	..	51	
Oats	66	..	64	
Corn Crops	..	125	.. ..	115
Turnips and swedes	66	..	66	
Tares and potatoes	..	..	5	
Green Crops	..	66	.. ..	71
Seeds, first year	57	..	1st year .. 59	
„ third year	35		2nd „ .. 38	
		92		97
		283		283

It appears from this statement that rather more than two-fifths of the Arable land is in Corn, about one-fourth is in Roots, and one-third in Seeds.

The main business of the farm is, as might be expected, Sheep breeding; but some Cattle feeding is carried on both in winter and summer, there being some excellent feeding pasture.

There are two distinct flocks of ewes kept on the farm, one on the Hill, the other on the sheltered and more fertile lower land. The Hill flock, of about 400 ewes, is of pure half-breds, and was started some thirty years ago by crossing Cheviot ewes

with Leicester tups. Young home-bred ewes are brought in every year, and after three crops of lambs have been taken they are drafted out. The tups are also bred upon the farm by pure Border Leicester rams put to pure Cheviot ewes, a small flock of these being kept for the purpose.

The Hill pasture is of a very superior character. It is generally considered that one ewe requires two acres of hill, and here there are nearly as many ewes as acres; but it must be stated in explanation that for three months in the winter the hill flock gets hay and corn and turnips. If the farm will not supply these, keeping is bought, and the hill is cleared for a while, which no doubt contributes to its healthiness.

The Valley or In-field flock of about 250 ewes is styled a three-quarter bred one, as containing a larger mixture of Leicester blood. Old half-bred ewes are brought from the hill and put to Leicester tups—and the crossing is continued until the Leicester blood becomes too predominant and the sheep are too fine for the climate. The lambing time with the In-field sheep begins in the last week of March, and with the hill flock in the 2nd week of April. The death rate is said to be rather high. With regard to the produce of lambs, it is considered satisfactory if one lamb to an ewe is raised on the hill, and 1½ lamb to 1 ewe in the valley. The wether lambs, and such of the ewe lambs as are not required to keep up the flock, are sold in July or August.

Our first visit to Great Ryle was made on the 17th of December, on a bright frosty day with the earth as hard as iron under our feet. We made a pretty complete tour of the southern half of the farm, and "cuts" of the hill sheep were brought down at various places for us to see by samples what they were like. The valley flock were seen in the pastures and the ewe hoggets on the turnips, where they were getting a little cut hay. The Cattle were inspected, as also the roots and the buildings.

At this time there were on the farm:—

12 *Horses*:—All workers (10 being the usual number).

61 *Cattle*:—

- 13 steers, fattening in foldyard.
- 3 heifers fattening in foldyard.
- 2 heifers, feeding and suckling.
- 2 calves.
- 12 steers fattening in byres.
- 2 heifers fattening in byres.
- 13 steers, stores for grazing.
- 3 heifers.
- 7 stirks.
- 3 cows in milk.
- 1 calf.

1065 *Sheep* :—

425 half-bred ewes of 3 ages on the hill.
269 three-quarter bred ewes.
54 Cheviot ewes.
21 half-bred tups (hoggets and older tups).
6 Leicester tups.
154 half-bred ewe hoggets.
127 three-quarter ewe hoggets.
9 sundries.

The Cattle on this occasion were of fair but not of remarkable quality. Some were ready for the butcher, particularly the heifers, which were more matured than any we had seen in Northumberland. The two calves sucking were bigger than their dams, and both dams and calves were fat. None of these feeding animals were getting more than 3 lbs. of cake with some barley-meal, cut hay, and turnips. The steers had straw and turnips only. The horses were not in very good condition. On this occasion we were not much taken with the hill sheep. They looked blue in their skins and in poor condition, as if they had had a check and the wet autumn had been unfavourable for them. The Infield flock was, however, much admired. They were large long sheep of very even type. The young sheep were level and in fair condition.

The Turnips were not good, one lot had been grown from a bad stock of seed, and most of the roots were misshapen. We learned that the harvest had been a fearfully late one, but we could not find out exactly when it had been completed; some gossips told us that it had been finished by carting the corn into the crew-yards in order to put it out of our sight. There is no doubt that in this district corn was standing out in December, and however well it may have been attended to it could then have been of little value.

The second visit was made on the 11th of May, by Messrs. Hope and Jordan, the reporting judge being ill at the time.

The Barley and Oats had come up regularly and well. Swedes had been sown on land well prepared. The seeds for mowing had been stocked with sheep; but were nevertheless very forward, and a grand plant. The grass land had been eaten off very bare, but it had the appearance of being very good land.

The live stock then on the farm was—

Horses as before, with the addition of 1 *foal*, and they were now in good working condition.

57 *Cattle*:—

18 heifers on grass bought in recently at 13*l.* 10*s.* 0*d*, each.
5 steers „ } $1\frac{1}{2}$ to 2 years.
3 heifers „ }
1 „ in calf.
2 „ suckling.
2 calves.
6 bullocks, 3 years.
9 steers and heifers, $2\frac{1}{2}$ years.
7 heifers, $2\frac{1}{2}$ years.
2 fat bullocks.
2 cows.

The Cattle (all bought in) were in healthy improving condition, 6 bullocks in the yard forward.

Mr. Hope's report on the sheep was: "Very favourably impressed with sheep stock. Ewes better all round than I expected to see them, from my impression at last inspection; three-quarter bred ewes, very good class, good size, well woolled, uniform in type, apparently very healthy and hardy. Half-bred ewes good. Ewe hoggs level and good. All rams of good type."

Mr. Jordan reported in similar terms and added: "The lambs were all exceedingly good, the flock seems to be very well managed, and to have been bred with judgment." Lambing had begun on the 23rd of March with the valley flock, and on the 9th of April with the hill flock. The lambing time had been a very favourable one, dry and healthy.

Our final visit was made on the 1st of July, one of the hottest days of the year. The morning had been spent in walking over Mr. Hedley Davison's farm, a few miles distant. We were told that the thermometer was 90° in the shade; but whatever it was, we went through with our work and traversed almost every field—but we did not attempt to walk over the hill. The drought had made some of the corn crops rather short and stunted, but most of the Barley and Oats was very good. The seeds were very fine, and quite fit for mowing; but Mr. Drysdale had been so busy with turnip-hoeing that he did not want to have his hay on hand at the same time. The swedes varied a good deal; some were remarkably fine. One field was then being sown with turnips. The cultivation for this crop is so similar to what has been already described, that it is not necessary to dwell upon it, except to say that Mr. Drysdale puts on from 16 to 20 loads of dung, and from 5 to 7 cwt. of vitriolized bones. The swedes get the larger, and the common turnips the smaller dressing. The grass was for the year plentiful. In one field of $13\frac{1}{4}$ acres were 12 beasts, a mare

and foal. They were up to their knees in grass. The beasts were getting as much meal as they could eat, and were fat. All the Cattle and Sheep were good in character, and thriving. The wool which we inspected in the granary was white and sound.

The following account was given of the stock then in hand :—

81 *Cattle* :—

2 cows.	9 breeding steers, 2 yrs.
1 with calf.	13 grazing heifers, 2 yrs.
1 calf, sucking.	5 „ steers, 1 yr.
1 quey with calf, sucking.	5 „ heifers, 1 yr.
8 breeding steers, 3 yrs.	4 calves.
27 „ heifers, 3 yrs.	5 cows belonging to hinds.

994 *Sheep* :—

105 half-bred ewes,		with 210 lambs.
255 half-bred ewes,		with 255 lambs.
10 half-bred eild [barren].		
18 half-bred ewes, Leicester tup,		with 36 lambs.
8 half-bred ewes, Leicester tup,		with 8 lambs.
4 half-bred eild.		
400 ewes	and	509 lambs.
138 three-quarter bred ewes,		with 276 lambs.
99 three-quarter bred ewes,		with 99 lambs.
11 three-quarter bred eild.		
248 ewes	and	375 lambs.
20 Cheviot ewes,		with 40 lambs.
28 Cheviot ewes,		with 28 lambs.
4 Cheviot eild.		
52 ewes	and	68 lambs.
146 half-bred gimmer ewes.		
118 three-quarter bred gimmer ewes.		
25 tups.		
5 culls.		
Total 994 sheep	and	952 lambs.

The number of lambs is perhaps partly an estimate, and subject to some discount, as they are not counted every day; but if it was only approximately correct, it shows a very good fall—425 half-bred ewes in December are 400 in July, and their lambs are about 500, or 117 for 100 put to the ram; and the loss in ewes was about 6 per cent. The In-field flock was in December 269 ewes, in July 248, with 375 lambs. The

lambs here were 139 per 100 ewes, and the loss of ewes 7 per cent., the loss on the gimmer ewes 6 per cent.*

The shepherd of the flock, Adam Hindmarsh, was highly recommended to the Judges by Mr. Drysdale, as having been a faithful servant for 26 years. His father was shepherd before him, and is still living on the farm. Until seven years ago, Adam the Younger † was a spade hind, but when his father retired he succeeded him. The Judges had great pleasure in endorsing Mr. Drysdale's recommendation, and bringing his name before the Council of the Society as deserving a certificate of merit.

The old system of paying the labourers a good portion of their wages in kind is still in force here, and a full account of the form which these payments take is as follows:—

Steward.—16*l.*, house and garden rent free; 1 stone of cast wool; 2 small pigs; keep of 1 cow; 4½ old bolls = 27 bush. of Barley; 5½ old bolls = 33 bush. of Oats; 10 bush. of Beans or Peas; 1000 yards of Potatoes. ‡

Shepherd and Under-Shepherd.—24*l.*, house and garden rent free; keep of cow; 20 ewes, 10 hoggs, and the same corn as the steward. The shepherd pays his mate out of these wages.

Three of the *Hinds* have house, &c.; keep of a cow; and 11*s.* a week. The other has house and 15*s.* wages a week.

Each householder finds a woman-worker at 1*s.* 3*d.* a day, with 3*s.* a day for 20 days in harvest.

Few of the labourers draw any money until the end of the half-year. The amount of wages they receive is not so great as on some other farms; but they are probably just as well off as

* Compare on this subject of the produce of ewes and the average losses in breeding flocks some statistics collected by the South Newton Agricultural Society, South Wilts, and published in Little's Report on the Southern Counties (Royal Commission on Agriculture, [C. 3375, 1882] page iii.):—

Number of Lambs per 100 ewes 97·5; Losses 4 per cent.; young sheep 1 per cent., 10 Oct. to 1 May.

† There are four Adam Hindmarshs on the farm; Old Adam, Young Adam, Little Adam and Wee Adam.

‡ The cash value of these incomings, according to an estimate made by the present reporter, would be about as follows:—

	£	s.	d.
Wages	16	0	0
House and garden	4	0	0
Wool	0	10	6
Pigs	2	0	0
Keep of Cow	10	8	0
Barley	4	11	0
Oats	4	2	6
Beans or Peas	2	5	0
Potatoes, 27½ perches	3	0	0
= 18*s.* a week.	£46	17	0

those who receive a greater amount in money. The payment of wages in kind has often been denounced, but no doubt it has its advantages, and the general opinion in the North is that the position of the labourers has not improved where this system has been discontinued.

To return to the management of the farm, the fences and gates were well kept. The buildings and stackyard were not very tidy, but the shabby old buildings supply some excuse for this—the whole appearance of the farm and the stock upon it suggested a good subject well and liberally treated. Mr. Drysdale produced no accounts, neither did any of his competitors; and the Judges had to form their own conclusions from what they saw and heard on the occasions of their visits. They were unanimous in awarding the first prize to Mr. Drysdale.

Mr. Hedley Davison's Farm, Scrainwood, Rothbury.

Second Prize in Class 3.

This farm, containing about 1060 acres, forms the entire township of Scrainwood, in the parish of Alnham. It lies about seven miles north-west of the town of Rothbury, and is the property of Mr. W. C. Selby, of Biddlestone Hall. It has been in Mr. Davison's occupation about five years; he hires it from year to year at a rent of 760*l.* It is tithe free, and the rates amount to about 70*l.*

The entry to the farm is at May-day (13th May). The tenant is not allowed to take two white-straw crops in succession. At quitting, he is entitled tc an away-going crop on 120 acres, which the landlord is bound to take at a valuation.

The farm lies rather out of the way among some of the outliers of the Cheviot Hills, and at least seven miles from a railway station. The Scrainwood Burn, known also as the Wreigh, or Wreeth, coming down from the hills to join the Coquet a little above Rothbury, cuts the farm in two. In the lower valley of this burn are some flats of pasture on a gravel subsoil, and there the grass is early; but these flats are very subject to floods. The homestead is placed a little above this burn and in the centre of the farm. At this point the elevation is about 550 feet above sea level. From it the ground rises in almost every direction. To the west lie Ewe Hill, 800 feet, and Harden Hill, 1072 feet high. This is the portion of the farm described as "hill or moor" in the entry form.

The extreme east of the farm is occupied by rough pasture of more than 200 acres, rising to 646 feet, and this might not

unfairly be classed as moorland. Between these two moors lie the arable and pasture lands, the latter being mainly near the burn; the arable land rises in one place to more than 700 feet, while nearly 90 acres of it lie between 600 and 700 feet, the remainder ranging from 550 to 600 feet above the sea.

The homestead includes a very roomy and comfortable house, with an old-fashioned well-kept garden in front. The farm buildings lie on the southern side of the house, but they are not fully in view, as the house fronts rather east of south. These buildings are substantial. There are three open foldyards, which are rather large and cold for such an elevated position; they are sheltered on the north, east and west, and open to the south. There are eight feeding boxes, a byre and calf pens. In the barn a threshing engine is driven by an overshot water-wheel, which also works a dressing machine, a mill, a chaff-cutter, and a sawmill. There are good stables, a straw barn, granary, implement shed, waggon hovel, and blacksmith's shop. At the south-west corner of the building is the foreman's or steward's cottage, of two rooms and two little pantries. There are five other cottages at about 150 yards to the south-east of the buildings. These have more accommodation than the steward's has; the cottages which we visited were very comfortable, well furnished and clean.

The soil of the farm varies from very light and stony soil to strong clay land: some of the latter description, formerly arable, has been laid away to grass. The lighter and warmer soil suffers severely in a drought such as that of 1887. Lime is found to have a very beneficial effect, and it has been largely applied by Mr. Davison. About 250 tons a year are used at the rate of 5 to 6 tons an acre. The lime costs from 8*s.* to 8*s.* 6*d.* a ton, besides the haulage, which costs about 8*s.* more. It is put on the land in course for roots, or on the old seeds before the land is ploughed up for Oats. Sometimes it is applied fresh when it comes from the kiln, at other times it is laid in large heaps and put on in the spring.

The acreage of the different descriptions of land is given in the entry certificate as follows:—

Arable, 273 acres; pasture, 384 acres; and hill or moor, 405 acres—but the distinction between pasture and hill or moor is not very definite, and some land seems to be at one time described as arable and at another as pasture. The arable fields, many of them, have shelving banks of grass, haughs and old quarries, so that it is difficult to ascertain the exact extent of the land under the plough. Mr. Davison stated that he had last year about 90 acres in corn, 60 acres in turnips, 54 acres one

year's ley, and 60 acres 2 years' ley. This year the approximate quantities were :—

Corn Crops, 114 acres.		Green Crops, 56 acres.		Seeds, 93 acres.	
	acres.		acres.		acres.
Barley	48	Turnips and Sweeds	50	1st year	40
Oats	66	Potatoes	3	2nd year	53
		Tares	3		

The usual course of farming is to break up the seeds after two or more years' ley and to sow with Oats. This is followed by Roots, and after them Barley or Oats are sown. The whole of the corn is sown broadcast, and most of it by Mr. Davison himself. Like all the work on the farm, it is well done.

The Cattle are not such an important branch of the farming as the Sheep. Those kept are all reared on the farm, and they are mostly sold off as steers. From 18 to 20 calves are annually reared on boiled linseed and milk.

The flock is here, as on all hill farms, the mainstay of the business. On the high and exposed hill to the west, called Harden Hill, which lies from 700–1100 feet high, Cheviot ewes (about 330) are kept, and they are put to Cheviot rams. These ewes have three crops of lambs; they are then brought down to the lower land and crossed with a Leicester ram. On the lower part of the farm half-bred ewes (about 330) are put to half-bred tups, and when they are drafted out of the Hill flock they are put to Leicester tups.

There are thus four distinct types of lambs on the farm :—

1. By Cheviot rams out of Cheviot ewes.
2. By Leicester rams out of Cheviot ewes.
3. By Half-bred rams out of Half-bred ewes.
4. By Leicester rams out of Half-bred ewes.

The ewe lambs of the first of the above classes are put into the Hill flock, the wether lambs are drafted to another farm or put out to keeping, and they are sold at three years old. The wether lambs of the 2nd Class (except such as are saved for tups) and of the 3rd Class, and all the lambs of the 4th Class are sold in the summer or early autumn.

The Hill flock begins to lamb about the 10th of April, and that of the In-field 3 weeks earlier. The lambing folds for the latter flock are moved every year.

We inspected this farm on the 17th of December on a bright frosty day, which was very favourable for our getting over a

good extent of ground. We saw all the arable land, the Sheep and Cattle on the lower land, and a considerable number of the Hill Sheep. At that time the stock was as follows :—

18 *Horses :—*

8 workers.
2 odd.
2 cart foals.
3 brood mares (2 of them blood).
2 three-year-old blood fillies.
1 yearling colt and 1 foal.

68 *Cattle :—*

19 fattening (7 steers, 10 heifers, 2 cows).
7 cows in-milk, including 2 belonging to the hinds.
16 Two-year-old heifers and steers.
25 yearling heifers and steers.
1 calf.

1115 *Sheep :—*

329	Cheviot ewes put to Cheviot tup.	Total 785 ewes.
121	Cheviot ewes put to Leicester tup.	
335	Half-bred ewes to half-bred and Leicester tups.	
142	Cheviot ewe-hoggs.	
132	half-bred ewe-hoggs.	
20	shot ewes feeding.	
33	tups.	
3	lambs.	
1115		

Of the 1115 sheep, 618 were Cheviots, 488 Half-breds, 4 Leicester tups, and 5 Blackfaced tups which belonged to another occupation.

The horses were good active horses in capital condition, and everything about them and in their stable was smart and trim. They were getting 8 stones of oats a week, long hay and oat straw. Their hours of work are summer 6 A.M. to 11.15 A.M. and 1.30 P.M. to 6 P.M.; in winter from daylight to 11.45 A.M. and from 1.15 to dark.

The Cattle fattening were some in feeding boxes and some in open yards. They were getting hay, roots and meal. The yearlings and 2-year-olds ran into pastures near the homestead during the day, where they got a few turnips, and at night they were brought into the yards and got hay and 2 lbs. of mixed barley and maize meal. They were none of them remarkable.

The Sheep stock were of a much higher character. The Cheviot ewes looked rather small, but they were very level, and the Judge best acquainted with this kind of farming declared

them to be suitable for the bleak and cold country in which they have to find a living. The half-bred ewes were good, and all the rams very good. The shot ewes and the hoggs were on white turnips, and were well done by. The roots, 60 acres of swedes, yellow bullocks and white turnips, were of excellent quality, and, considering the soil and climate, good crops. The arable land was clean, and everything about the farm neat and in good order. Forty-eight acres of oat-stubble had been ploughed up for roots, and the work of the farm was well forward.

In passing over the farm we were shown an excellent dipping pen which Mr. Davison had constructed. In a hollow, where a small rill gave a sufficient supply of water, a trough 11 feet long and 21 inches wide had been sunk in the ground. At one end of this trough was a folding-pen, and at the other end were a couple of draining-pens paved with grooved bricks, and sloping to the trough so as to return the drainings from the sheep to the trough. The sheep are passed through the trough to one of these pens, and when this is filled it is closed, and the other filled; by the time that the second pen is filled the sheep in the first are in a state to be turned out. The sheep are all dipped in Cooper's dip in the summer, and McDougall's in the autumn. We saw also a shallow trough through which the sheep are driven to cure them of foot-rot. The farm is said to be unhealthy for sheep, and Mr. Davison said that he could never fold the hill sheep at night even for clipping. On one occasion when he had shut them up, he lost twelve in one night from black leg.

The second inspection was made by Messrs. Hope and Jordan on the 10th of May, and from their notes it appears that at that time the stock on the farm was as follows:—

Horses:—As at last inspection, except that a steeple-chaser had been sold for 220*l*.

67 *Cattle*:—

16 two-year-old stores to be sold at Rothbury in the following week.
25 yearlings.
8 cows (including 2 belonging to the hinds).
18 calves.

These were all in good condition—calves, very good.

1052 *Sheep*:—

328 Cheviot ewes with lambs by Cheviot tups.	767 ewes.
119 Cheviot ewes with lambs by Leicester tups.	
320 half-bred ewes with 444 lambs.	

131 Cheviot ewe-hoggs.
126 half-bred ewe-hoggs.
28 tups of various ages and kinds.

Since the last visit 25 sheep had been sold or consumed. The losses by death had been 38. It is a remarkable fact that only one Cheviot ewe of the hill flock had died in the interval (21 weeks). The losses among the half-breds had been more serious, the deaths occurring chiefly among the older sheep. The Cheviot ewe hoggs had been during part of the winter at keeping in Durham at *3d.* a head a week. The loss had been 11 out of 142, which was said to be unusually large. The 132 half-bred ewe hoggs of December were now 126. The lambs of the Cheviot ewes were not enumerated, about 50 of them had still to lamb. The half-bred lambs numbered 444, which is about 131 lambs for 100 ewes put to the ram. The lambing season was described as the best the shepherd had ever experienced at Scrainwood, and this was attributed to the dry spring.

The flock generally was noted as good and even in character, the lambs as blooming—the half-bred ewe hoggs were specially commended.

Thirty-eight acres of Barley sown after Swedes, on the 16th of February, with 2 bushels of seed an acre, were found strong and healthy.

Twenty acres of Oats after ley, sown 28th of March, looked very well, and the seeds were very fresh.

The Turnips were then being sown. Two ploughs were employed in ridging and splitting the ridges again. Two men filled 2 carts with dung, four women spread the dung between the ridges—one man was sowing the artificial manure, and the steward was superintending the work, which was carried on in a thoroughly business-like manner. This land, which, as has been noted, was ploughed before our visit in December, had been three times ploughed, since then limed, frequently grubbed, and made thoroughly clean; 15 to 18 loads of good farmyard-manure were applied with 2 cwt. Liebig's guano, 2 cwt. superphosphate of lime, 2 cwt. bone-meal, ½ cwt. sulphate of ammonia. The sorts sown were Greentop, White Globe, Yellow Bullock, and Hybrid Yellow.

Our final inspection was made on the 1st of July, on a blazing hot day. Curiously enough, each visit to this farm was made on a day perfect of its kind, while in the case of another farm which we visited three times, it rained every time almost incessantly. By making an early start from Rothbury, however, we managed to get over a good portion of the farm before the heat of the day became too great. Some of the corn showed the effects of the drought, and the swede turnips, sown rather late (because the land was subject to "runch" *), looked very blue,

* Charlock, *Sinapis arvensis.*

and as if nothing could save them. The stock looked exceedingly well. One piece of Barley (38 acres sown in February) was a very fine crop, and 40 acres of new seeds for hay, which was stocked up to the 10th of May, was very heavy. The 53 acres of second year's seeds was a splendid pasture. In it were 190 ewes, 300 lambs, 22 cattle, and 9 horses. This was described as a rather ordinary piece of land, but it had been limed about three years ago, and pretty well assisted with manure and roots consumed. The common turnips were a very thick plant, 3 lbs. of seed had been sown, and the plants were "as thick as hairs on a cat's back." They were then being singled by 4 women, 4 men, and 2 boys, the women leading the work, and giving the men as much as they could do. Some of the Oats looked stunted in growth, but they were not past recovery.

Within three days of our visit, a fine rain fell on this farm, and knocked the Barley and Seeds about very much, but no doubt the Roots and the Oats benefited considerably. Taking into consideration the soil, the situation, the climate, and all the conditions under which the farm is carried on, we thought that it did Mr. Davison very great credit, and that there was ample evidence of skill, enterprise and good management. There was also a careful attention to details, and a thoroughness in the work which is most commendable.

The following account of prices realised for Half-bred ewes and Lambs for the last three years has been furnished:—

Ewes.					Lambs (excluding Shots).				
	s.	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*
1885	37	0 and	37	3	1885	14	0 to	23	6
1886	48	6 „	49	0	1886	15	3 „	24	0
1887	45	0 „	46	0	1887	21	0 „	24	6

The accounts of profit and loss were not open to us. It is hoped that Mr. Davison, if he has not recently made much profit, may in the future reap the reward of his very spirited improvements at Scrainwood.

The labourers' wages here do not differ greatly from those already noticed. The hired servants are—Steward, 4 ploughmen, 1 boy, 6 women, 1 byre-lad, and 2 shepherds. The steward has 50*l.*, a pig fed, potatoes and old milk found, and house rent free. The ploughmen have 15*s.* to 15*s.* 6*d.* a week, house, and 1000 yards of potatoes. Women have 1*s.* 3*d.* a day, with 3*s.* a day in harvest. The shepherd takes no money. He has keeping for 21 half-bred ewes, 11 ewe hoggs, 13 bolls (26 bushels) of corn, and the keeping for a cow; for this he boards a man who helps him. The cows are milked by a daughter of one of the hinds, who also makes the butter, feeds the pigs, and looks after the poultry, which have been hitherto

overlooked, though they are numerous and good. The dairy-maid is paid 1*s.* 6*d.* a day. One of the labourers' wives gave the following information as to her family and their earnings. She had 10 children, 8 of them at home, their ages ranging from 2 to 18. Her husband got 15*s.*, &c., as described; one boy of 17 got 12*s.*, another of 14 got 7*s.*, and a girl got 7*s.* 6*d.* a week; four of the other five went to school. The income of the family is thus at least 107*l.* a year, with no rent, rates or taxes to pay out of it.

Mr. Davison recommended his steward, James Weatherburn, to the notice of the Judges. He has been ten years in Mr. Davison's service—at first as a spade hind, then rising to the post of steward. He was said to understand his work thoroughly, and to be most industrious and careful, sparing no pains in his master's service. The Judges were glad to be able to recommend him accordingly as deserving a certificate of merit.

It would be easy to find in other farms than those already described some subjects of interest, but it would be impossible to notice them all. Mr. Robson [Class II., No. 8] showed us first-rate Cheviot Sheep. Mr. Lawson's farm [Class II., No. 5], after it was entered, suffered immensely from a flood, which covered 70 acres out of 110, washed away at least an acre with its crop of turnips, and left a deposit of mud and sand on seeds and grass, and destroyed any chance which he might have had in this competition.

In the case of Mr. Hall's farm [Class II., No. 3] we were much pleased with the way in which the particulars likely to be asked for by the Judges had been prepared beforehand by Mr. Hall the younger, who, though living at home, is a student in a surveyor's office. These particulars included a map on which were shown the lines of old fences which had been removed, new fences planted and drains laid by the tenant; a Field book, which gave an account of the cropping and manuring of every field for the five years preceding 1887, accounts of Receipt and Expenditure for two years, with details of the valuations, sales and purchases and Balance-sheet. All these were prepared in a workmanlike manner, and the accounts stood the test of a careful examination by the reporter at home. The Judges trust that it will give some gratification to Mr. Hall, jun., to know that they highly appreciated and commended his work.

Conclusion.

A few concluding notes must be added to this Report.

The Judges have to thank the competitors for the very great kindness and hospitality with which they were treated. This

kindness was so general that it would be invidious to particularise. Everywhere they were made to feel that they were welcome, and there was a general disposition to give the information required, and to facilitate the work of the Judges as much as possible.

Reviewing the Agriculture of these two counties, as exemplified by the competing farms, there is much to admire. There is abundant evidence of the employment of capital and skill, with a very inadequate reward. If agricultural depression has not been as severely felt here as in some other counties, it has left its mark, and if the present prices of Beef and Mutton should continue, it is to be feared that worse times are yet to come for the breeders of Sheep. Those who farm near to large towns may hope to find an increasing demand for many things in the production of which the farmers of more remote districts cannot compete with them. The latter must continue to rely on the production of corn or meat or store stock, and in none of these lines is the prospect very bright or promising.

It may seem strange, after saying this, to recommend the increased breeding of Cattle. Nevertheless there is throughout the whole country such a scarcity of well-bred store cattle that they command prices out of all proportion to the value of meat. There must be plenty of land in Northumberland suitable for the breeding and rearing of young cattle and now occupied by inferior Irish stock. Nothing surprised the writer so much as the second-rate character of the greater number of the cattle which came under notice. We were told that the farmers would gladly buy better animals, but they found them so dear, and they could make the most profit out of young Irish steers. These are bought at low prices, pushed on quickly, and sent off to market, when a Norfolk or Lincolnshire farmer would think them about fit to be put into the feeding stall.

Of late years there has everywhere been a great extension of an old system of laying down land to grass for three or more years instead of one year. The objects in view are to decrease expenses, and particularly the cost of labour, and to give the land time and opportunity to recover fertility. In Northumberland this system appears to have been frequently carried to an extreme. Land is kept in ley until it produces little or nothing, and then ploughed out. It has been laid for too long or too short a period; too long for the grasses sown—too short a time for it to store up fertility. On the other hand, land which has been pastured and manured for eight or nine years, until it has got a good face upon it and the critical time is past, is broken up because it has become good enough to grow a crop of corn.

The seed mixtures of which we obtained particulars seemed to contain a fair variety of Clovers and useful grasses, but very commonly the crops were overburdened with Rye-grass and deficient in Clovers. In one field which had been sown with an expensive mixture, there was hardly a sign of anything but Italian Rye-grass.

After this slight criticism of Northern farming, I must conclude my Report by thanking my colleagues for the assistance which they have so freely and kindly given me.

XXVI.—*Report on the Horse-Shoeing Competition at Newcastle.* By CHARLES CLAY, of Walton Grange, Wakefield, Steward of Horse-Shoeing.

THE Royal Agricultural Society must be congratulated upon the successful issue of their new departure, the improvement of the Horse-Shoeing of the country. It would be difficult to point out a field of operations which, though of apparently minor consequence, so seriously affects the well-being of the most useful of our domestic animals, and is of so vital importance to agriculturists.

That this question of horse-shoeing should only just have come under the purview of the leading Agricultural Society of the kingdom is perhaps somewhat remarkable; but the Society having recognised its importance, promptly organized a competition at Newcastle, which all interested in horseflesh, and the public generally, agree was carried out in a most thorough and satisfactory manner. The prizes offered were undoubtedly considered very liberal, in proof of which I may state that the competitors passed a unanimous resolution, "thanking the Council for the very handsome prizes offered on this occasion." This resolution I was requested, as Steward, to bring under the notice of the Council, who ordered it to be entered on their minutes.

The entries were 42 in number, divided into 4 classes:—1st, Agricultural Horses; 2nd, Dray Horses; 3rd, Hunters; 4th, Roadsters. In each of these classes five prizes were offered: 1st prize, 6*l.*; 2nd, 4*l.*; 3rd, 3*l.*; 4th, 2*l.*; and 5th, 1*l.* Of the 42 competitors 41 actually appeared in the arena, one being absent from illness.

It will be the province of the Judges, whose report I have the pleasure to append, to remark upon the character of the work, but it may be permitted to me to say that the competition was

very close, especially in the Agricultural Class. All the men evidently entered upon their work with a full determination to win if possible, and there can be no doubt that the effect upon both the successful and unsuccessful will tend to improvement for the future.

That it is time something more were done to raise the standard quality of our horse-shoeing was, however, very evident, even to a non-professional observer, and it is to be hoped that the Society may be induced to include competitions of this kind in their programme for some years to come.

On the Tuesday afternoon His Royal Highness the Prince of Wales, accompanied by Prince Albert Victor and Prince George, together with Lord Egerton (the President), Mr. Jacob Wilson (the Honorary Director), and several other members of Council, honoured this department with a visit, all evidently taking much interest in the proceedings, and I venture to say that this new departure has the hearty support of His Royal Highness and all his friends.

The public also manifested great interest in the competition, as evidenced by the crowds who were constantly gathered round the enclosure. By a rough calculation, made at various times, I came to the conclusion that the spectators numbered from 800 to 1000 on the first two half-crown days; but on the Thursday they kept the place uncomfortably crowded, and I estimated that at no time were there less than 1200 persons present, while about the close of the contest, from 2.30 to 3.30 P.M., at least 2000 surrounded the ring.

The arrangements made by the Honorary Director and the Surveyor were admirable in every respect. There was ample space for the men to work in, for the horses to be shod, and for the Judges and officials; while the Grand Stand for the public, though apparently extensive, was not larger than the event proved to be requisite.

In the belief that the present is a favourable opportunity, I venture to add to my formal Report a few suggestions, which, however crude, may possibly lead to advantageous results.

These Shoeing Competitions are not, I think, altogether what the Society should rest content with. It is clearly a rough-and-ready method of bringing out the best of the workmen who do enter themselves, and it establishes the fact that though we possess many competent men, there are more who are not satisfactory shoeing-smiths. But having selected the best forge-men, have we any guarantee that they really understand the anatomy of the horse's foot?

I am sorry to say, speaking from considerable experience, that I believe many (in fact, most) of our men are very deficient in

this respect. They know nothing whatever about the position of nerves, or about the object which nature has in providing the inside of the hoof with that important cushion called "the frog;" while the hoof (to judge by the way many cut, burn and rasp at it) is looked upon as so much inanimate matter, placed there to be carved and polished as an ornamental adjunct to set off their much more esteemed iron shoe.

I trust it is no more beyond the province of this Society than it is beyond their capacities to adopt some method of insuring (or at least giving the first and second prizemen in each class an opportunity of acquiring) a more scientific knowledge of the horse's foot than it is possible for nine-tenths of our country smiths to obtain.

If the Society could see their way, either alone or in conjunction with the London Farriers' Guild, who have already taken some interest in this question, to give "Diplomas of Merit" after a proper examination and practical work done extending over a reasonable period (but not unduly to interfere with the men's avocations), I am of the opinion that we should have a much more intelligent use of the knife and rasp, as well as a great diminution of that bad but very prevalent custom of burning on the shoes. A smith so instructed, and holding such a guarantee of efficiency, would become a centre of improvement for the district in which he works. He would command more confidence from the public, and would impart his knowledge to his youths and apprentices with much more technical accuracy; and in time, as the Society's operations went on, the whole kingdom could not but feel the benefit of this improved and more humane system of shoeing our horses.

Up to this point I have not mentioned the importance of this question from the animals' point of view. Could they, however, be called in, I imagine the evidence they could furnish would revolutionise the present barbarous proceedings in much shorter time than I fear the feeble efforts of their present advocate can ever hope to accomplish it.

With these remarks I leave the future in the hands of the Council. There seems no possible reason why the competitions should not be continued. The Society having succeeded in this first effort, it would be well to go on until a better system can be worked out.

Judges' Report upon Horse-shoeing at Newcastle-upon-Tyne.

This, the first horse-shoeing competition of the Royal Agricultural Society, must be looked upon as a complete success.

There were several good workmen, but few that were really first-class all round. Some were fine hammermen, artists at the anvil, but they pared,

rasped, and burnt the foot far too much. Others were most careful of the foot, using neither knife nor hot shoe, but in other respects were poor workmen; and there were some slow and awkward, but yet their work when finished was very satisfactory.

The men appeared to attach too much importance to the time test, and as a result some of the shoes were badly fitted. Greater attention in the first place to the kind of foot they had to shoe, and an extra heat (which would have only required a little more time) would have remedied this serious defect.

Considering that the shoes were made from new iron, the time was not by any means good. In Class 1—Agricultural Horses—it varied from 24 to 33 minutes; in Class 2—Dray Horses—from 33 to 56 minutes; in Class 3—Hunters—from 32 to 50 minutes, and in Class 4—Roadsters—from 25 to 44 minutes.

On two of the days after the completion of the work, the Judges were called upon to address the competitors respecting the work, and to point out what should and what should not have been done.

We would suggest as an improvement that instructions should be given *before* the men start work, and further that the Judges should have power to stop any man who in their opinion was injuring a horse's foot; as it appears to us to be the duty of the Judges to protect the horses from injury, in the interest of the owners who have kindly lent them for the competition.

The whole of the arrangements for the convenience of the competitors, the general public, and the Judges were admirable. We beg to thank our steward, Mr. Clay, for his great courtesy, and the valuable assistance he rendered to us.

CLEMENT STEPHENSON.
J. D. BARFORD.
R. BRYDON.

XXVII.—*Report of the Senior Steward of Implements at Newcastle.* By HERBERT J. LITTLE, of Coldham Hall, Wisbech.

WITHOUT any indication of declining popularity, as evidenced either by want of welcome from the inhabitants, or diminishing attendance of visitors in its Show-ground, the Royal Agricultural Society has held its third meeting in Newcastle-on-Tyne; and whatever doubt might have previously existed in the minds of some members of the Council of the Society as to the policy of these reiterated gatherings in the same locality, must, I think, have been dispelled upon an inspection of the Yard. It was then apparent that close to one of the largest towns, and in the heart of one of the most important centres of population in England, a site had been secured for our Exhibition which, if not unrivalled for convenience, compactness, and general adaptability to its purpose, was without question one of the best, taking it all round, which the Society has succeeded in obtaining.

Though lacking the proximity of the sylvan beauties which

we enjoyed at Norwich last year, the Town Moor of Newcastle, stretching as it does up to the very doors of its freemen burghers, with its immense extent of turf, its elevation and its comparative levelness of surface, offers, it must be admitted, an exceptional situation for a Summer Show, where dry feet and cooling breezes for the brow are not the least of desiderata. Join to these advantages the contiguity to the Jubilee Exhibition, whose ground formed as it were a part of our own, and it will be understood why those whose previous experience in agricultural shows had given them an acquaintance with Newcastle and its capabilities, were disposed once again to link the fortunes of the Society with a city which had so many recommendations to offer.

But, indeed, independently of the excellence of the site which was available for our Show, and of the advantages enjoyed by the city in the matter of railway accommodation, the efforts of the Society were, from the first, so ably seconded by the local authorities, and such eagerness was displayed by the Mayor and Corporation to grease the wheels (metaphorically) of our huge machine, that there could be no reason to anticipate a hitch ; and in some of the finest "Jubilee weather" which has characterized the summer of 1887, the Newcastle Show was held with every sign of perfect success.

It must indeed be admitted that the attendance on the five shilling day was exceedingly small, and that the half-crown days did not come up to the expectations of the Finance Stewards : but these deficiencies were in some sense atoned for by the marvellous influx of visitors who poured into the ground on Thursday to greet the Prince of Wales and his sons, and to show their interest in agriculture. That was a sight to be seen, when the turnstiles and ordinary means of ingress to the yard proving wholly insufficient for the admission of the struggling crowd, a detachment of stewards stationed themselves at the remaining doors and filled their pockets with the shillings of the eager throng, whilst as far as the eye could see fresh multitudes pressed on, and the cry was "Still they come!" "Twelve miles of trains wait to enter the station," was the news by telephone in the morning, and not till 78,000 people had paid their shillings did the press abate!

But if the presence of Royalty at the Show excited, as it never fails to do, the enthusiasm of the multitude, there was ample evidence also that the visit of the Prince of Wales, of Prince Albert Victor, and of Prince George of Wales, to the popular President-elect of the Society was a source of gratification to Northumbrians of all ranks ; and the Society has much reason to be inspirited by the constant and unflagging interest

displayed by His Royal Highness in the success of its Shows and the furtherance of its interests by his presence.

The following prizes were offered by the Society in connection with its meeting:—

Prizes.	£
*Class 1.—Portable agricultural engine, self-moving or otherwise, on the compound principle, not exceeding eight-horse power	200
*Class 2.—Portable agricultural engine, self-moving or otherwise, on the simple principle, not exceeding eight-horse power	100
[The brake trials of implements entered in Classes 1 and 2 were designed to elucidate relative merit under the following heads:— Construction:—Efficiency—*i.e.*, proportion of actual work done to work indicated, economy of fuel, of steam, of lubricant, perfection of combustion, price.]	
Class 3.—Weighing machine for sheep and pigs	20
Class 4.—Weighing machine for horses and cattle	25
Class 5.—Best machine for planting potatoes	25
Class 6.—Best machine for raising potatoes, the price to exceed £5	20
Class 7.—Best implement for raising potatoes, the price not to exceed £5	20
Class 8.—One-man power cream separator, the price not to exceed £20, and to be capable of dealing with 20 gallons of milk per hour	25

The most important feature in connection with the Show was the competition for the Farm-Engine Prizes. Yet this was one of the things almost certain to be overlooked, except by those interested in the trials. These were conducted in an insignificant looking shed in a secluded part of the Show-ground, and they extended over some four or five days. These trials were so important in their character that they bid fair to mark an era in the history of agricultural engines.

Into the reasons which induced the leading Engine builders to abstain from competition in these trials, it is not necessary for me now to enter. That it was an unfortunate decision on their part I have little doubt; but, notwithstanding the fact that the greater firms were conspicuous only by their absence, some marvellous results were achieved by less known makers, which will be fully described in another part of this Journal. I can only place on record here the simple fact that Davey, Paxman and Co., to whom both prizes for Simple and Compound Engines were awarded, succeeded in beating the record of any previous trials, and performed the unprecedented feat of running on the brake for four hours under most critical supervision, at an expenditure of 1·85 lbs. of coal per horse power per hour in the case of the Compound Engine, and 2·6 lbs. in the case of the Simple Engine, whilst Messrs. J. and R.

McLaren of Leeds ran a good second to this remarkable performance. I fully believe that the determination of the Council to persevere in their Engine trials, notwithstanding much opposition, will be amply justified by the report of this competition prepared by Sir Frederick Bramwell and the Engineers of the Society.

The trials of Potato-planting machines which took place at Gosforth, a short distance from the ground, did not exhibit any important improvements in the manufacture of these implements, and in consequence of the extreme irregularity with which the sets were deposited by the whole of the machines, the Judges unanimously declined to award the prizes announced. The Potato-raising machines were tried on the same ground on October 4th. The weather was favourable and the land very suitable for the purpose. The First Prize in Class 6 was gained by Powell Bros. and Whitaker, Cambrian Iron Works, Wrexham; and in Class 7 by John Gregory, Westoe, South Shields. A Report on the trials has been prepared by Mr. John Coleman, one of the Judges, but its publication is unavoidably held over until the next number of the 'Journal.' The Stewards received much assistance from Mr. Henry Wallace in the preliminary arrangements for these trials, and their thanks are due to him for his ready and efficient help on that and other occasions.

The Cattle and Sheep Weighing Machines, strange to state, excited no competition, and Messrs. David Hart and Co. had a walk-over with their exhibits. These machines were of a useful character, but it would have been more pleasing to have seen some other competitors enter the list, especially at a time when so much interest was being displayed in the matter, and when a Bill was actually before Parliament on the subject of compulsory weighing at markets.

The Working Dairy has now become an established institution at our Shows, and for the first time this year had a Steward of its own, in the person of Sir John Thorold. The Cream Separator trials were therefore conducted under his supervision in a shed attached to the Dairy. In consequence of the withdrawal of one machine and the accidental breakage of another, the Laval Separator of the Dairy Supply Company was the only one which came before the Judges. The great heat which prevailed at the time prevented the milk being so entirely satisfactory in condition as it should be in such trials, but the machine was effectively worked by one man, and appears likely to prove useful in small dairies.

I have already alluded to the compactness of the Show-ground. This was in part owing to the largeness of the space available,

but also to the judicious limitation of ground hitherto allotted to implements under the recent rules as to charges. It has been a common complaint of late years that the ground was getting unwieldy in size, and I believe the new rules meet with the approval of many exhibitors as well as of the majority of visitors.

The Show was distinguished by no remarkable novelties, but medals were obtained by several exhibitors. The implements to which they were awarded will find full description in the Judges' Report, to appear in the next number of the 'Journal.'

Mr. Hemsley's absence from ill-health was a source of much regret to the Stewards, and especially to his colleagues in the Implement department, who much missed his ripe experience and thorough knowledge of the merits of machinery, as well as his genial companionship.

The reputation of the North for hospitality was amply sustained. The sumptuous banquet given by Lord Armstrong at Jesmond Hall was followed by the luncheon of the Mayor and Corporation in honour of the visit of the Prince of Wales, and both entertainments were fully appreciated and largely attended by those who were privileged to receive invitations.

I cannot conclude my Report without acknowledging the uniform kindness I have received from my colleagues during my three years' Stewardship, and the ready assistance always rendered me by the officials of the Society in every department, and without expressing the pleasure with which I look back on my experience as Steward.

XXVIII.—*Report on the Trials of Portable Agricultural Steam-engines, self-moving or otherwise, at Newcastle.*

By Dan. Pidgeon, Assoc. Inst. C.E., Reporting Judge.

Judges.

Hon. C. A. Parsons, of Ryton-on-Tyne.
H. Yates, of Grantham, Lincolnshire, and
Dan. Pidgeon, of Holmwood, Putney Hill, London.

Advised by the Society's Consulting Engineers, Sir Frederick Bramwell and Mr. William Anderson, as well as by Messrs. Pattinson and J. E. Stead, specially retained as chemists and analysts.

Agriculturists are aware that no trials of engines have been held by the Royal Agricultural Society of England since those which took place at Cardiff in 1872, and it will be well, therefore, in the first instance, to state what were the objects in

view, and what the circumstances under which the Society proposed, after so many years' intermission, to hold new trials of engines at Newcastle in 1887.

In 1881, or nearly ten years after the Cardiff trials, Mr. Anderson, Consulting Engineer to the Society, published an article on "Compound Engines for Agricultural Purposes" in the pages of the 'Journal,' with the professed object of laying before Agricultural Steam-users "the salient features and advantages of the Compound System in Steam-engines, and so to enlist their interest in the, probably, rapid adaptation of the principle to Agricultural Engines."

Compound engines, at the time in question, were in course of displacing simple engines in the steam-ship, the factory, the mill, and the mine; while their adoption for locomotive purposes was under consideration. Messrs. Fowler and Co. had, indeed, already shown a compound semi-portable engine at Kilburn in 1879, Messrs. Garrett, a portable compound at Carlisle in 1880, while Fowler, Garrett, Burrell, and Aveling, had all followed suit at Derby in 1881, before the Society's Engineer undertook to advocate the use of compound engines in agricultural practice.

Mr. Anderson began by showing that economy of fuel is impossible in the vast majority of portable engines, almost all of which have only a single slide-valve, and, consequently, a low rate of expansion. On the other hand, he pointed out that engines, fitted with expansion gear, automatic or other, are complicated in their details, and apt to get out of order, while the compound engine promises to effect all the saving of coal which characterises simple expansive engines with the use of simple valve gear. It was further argued that, although the compound system involved the use of a second cylinder, the boiler, having less steam to furnish, would become lighter, while, if the working pressure were increased to 120 or 150 lbs. per square inch, the compound agricultural engine of the future would probably weigh, and cost, little more than its spendthrift predecessor.

Mr. Anderson's indictment of existing practice was too weighty, and his anticipations of the advantages to be gained from a change of system too probable, to be without effect on the minds of the Council. In addition, it was patent that compound engines were fast superseding simple engines in the industrial world generally, while the portents of a coming change in agricultural practice were yearly becoming more numerous in the exhibits of the Royal Agricultural Showyard itself.

Finally, waiving certain old prejudices against high-pressures,

the Society determined upon offering a single large and indivisible prize at Newcastle for the best compound engine, and a smaller, but still considerable, prize for the best simple engine, limiting the nominal horse-power, in both cases, to eight horse, and not excluding self-moving engines from the competition, although applying no tests to the latter except as prime-movers. The chief, if not sole, object of these new engine-trials was to ascertain, in the interests of the agricultural steam-user, what really are the relative merits of simple and compound agricultural engines.

It is a matter of great regret that the determination in question, first officially announced in November 1886, was found displeasing to a number of the chief agricultural engine-makers in the country. These gentlemen met in the following month, and, after consultation, agreed to abstain from competing at Newcastle, chiefly on the ground that "a great deal more time should have been given between the announcement of such prizes and the date of the trials."

After duly considering the objections raised to their proposals by this important body of engine-makers, the Society determined to go forward with the trials, and events have proved that their judgment was correct. It is now known that two, at least, of the best engines competing at Newcastle, and these by different makers, were not commenced three months before the trials took place, while not only did both these "improvised" engines beat all previous performances of portable engines, but one of them about equalled in economy of fuel anything hitherto accomplished by the most economical *condensing* compound-engines in existence. It is scarcely invidious, under the circumstances, to say that the plea of "want of time" conveys an impression either of unwillingness or of unreadiness to enter upon a contest which has not only been won, but well won, without other preparation than that afforded by past experience, and an already acquired knowledge of the theory of steam.

To come to the practical question which the Society set itself to resolve at Newcastle:—"What are the relative merits of simple and compound agricultural engines?" Readers of the 'Journal,' not themselves engineers, may be assisted to a conclusion by a few moments' consideration of certain elementary physical facts upon which this problem turns; facts which, in the first instance, however, must be employed for the elucidation of a preliminary enquiry, viz., "Is there room, and, if so, how much room, for further economy in the modern steam-engine?"

Nearly fifty years have elapsed since James Prescott Joule, following in the wake of Count Rumford and Julius Mayer, made himself famous by demonstrating the "mechanical

equivalent of heat." It is now generally admitted that all forms of energy, due to the physical forces, are mutually convertible, with a definite quantivalence; and Joule showed what that equivalence is whenever heat-energy is converted into mechanical energy, or *vice versâ.*

He proved, experimentally, that the quantity of heat required to increase the temperature of water by one degree needs for its production the expenditure of a force measured by the fall of 772 pounds from a height of one foot. This is "Joule's Equivalent," which may be conveniently stated as follows: "A (British) unit of heat equals 772 foot-pounds of work."

Now a pound of pure carbon is capable of liberating, by its perfect combustion, 14,500 (British) heat units, equivalent to $(14{,}500 \times 772 =)$ 11,194,000 foot-pounds of work; or, if burned in one hour, equal to 5·6 horse-power. In other words, if it were possible perfectly to utilize *all* the heat-energy contained in a pound of carbon, only one-sixth of that pound would be required for the production of mechanical energy equal to one horse-power for one hour.

But the best coal is not all carbon, and is usually rated as yielding ten millions of foot-pounds of work per pound of coal consumed, while, again, coal burnt in a steam-boiler is not *all* utilized—more than a fourth of it being lost, even in the best boilers: so that the amount of work which a pound of coal is capable of doing in the furnace of a boiler becomes reduced to $7\frac{1}{2}$ million foot-pounds; roughly equalling, if the coal were burnt in an hour, four horse-power, or *a quarter of a pound of coal per horse-power per hour.*

Excellent as they were, the best engines tried at Newcastle burnt rather more than seven times this amount of fuel, and the worst, more than twenty-four times as much; while the records of the Cardiff trials immortalize, at least, one engine which burnt forty times more coal than theory demands per horse-power per hour. There is, then, evidently room and to spare for further economy in the best modern steam-engines, which, indeed, may be said, speaking generally, to consume ten times more coal than they would do if *all* the heat-energy of the fuel could be converted, without loss, into mechanical energy; a fact which compels the further question, "How is all this energy lost?"

Heat-energy, which cannot itself be conveniently applied directly to the production of mechanical effort, suffers a certain loss in being primarily converted into steam; but, since this loss is inherent in the steam-engine, its story ("fairy-tale of science" though it be) need not be told here; it is enough to point out how loss of energy occurs in the steam-engine, *after* heat has been converted into steam pressure.

Boiler steam, unlike a true gas, exists only in a "saturated" condition, in other words, it carries a load of water, so delicately adjusted in amount to the temperature of the steam itself that, upon the latter dropping ever so slightly some of the burden in question is thrown down, or "condensed," and this continues until a new adjustment has been made between the lower heat of the steam and the lesser burden of water which, under the new circumstances, it is able to carry. There is, further, a constant, although not regularly progressive, relation between the temperature and pressure of steam, pressure increasing with the temperature—the more rapidly the greater the pressure, and *vice versâ*.

In the "Simple" expansive engine, steam enters the cylinder at or about boiler pressure, and is shortly afterwards "cut off" by the action of the expansion valve. It then expands in accordance with "Marriotte's Law," the pressure halving as the volume doubles, until the end of the stroke, when it is discharged at a pressure slightly exceeding that of the atmosphere, and at a temperature therefore of rather more than 212°. But, since the temperature of steam diminishes with its pressure, a contraction due to cooling must, under these circumstances, take place in the cylinder, which contraction, acting in concert with the expansion, further diminishes pressure, so that, unless the steam receives heat during its expansion, the pressure will diminish even more rapidly than is demanded by Marriotte's law.

Now in a cylinder, which is necessarily made of metal (one of the best conductors of heat), condensation, followed by another evil, rè-evaporation, have both full play. In the case of a cylinder, unjacketed, and supplied with steam at, say 100 lbs. pressure, this, entering at a temperature of 327°, is rejected at a temperature of 212°, and the temperature of the cylinder itself must therefore lie somewhere between these two limits. Under these circumstances, every incoming puff of steam is cooled and partially condensed from the very outset of the stroke, while the resulting water of condensation is, in turn, re-evaporated from the walls of the cylinder; both processes involving dissipation of heat-energy.

This state of things is modified, but not remedied, by the use of a steam-jacket, which checks condensation and re-evaporation in the cylinder by transferring these operations to the jacket itself; an arrangement which is advantageous only because pressure is constant in the jacket, and variable in the cylinder. In any case, it must cost coal to keep up the temperature of a vessel filled, as the cylinder is, with a gas now hot, and now comparatively cold.

All loss of heat-energy means loss of mechanical energy; and the steam-engine is an apparatus having many heat-energy leaks, which the most skilful engineer can only partially stop, and the unskilful man altogether fails to find. Energy is dissipated with every puff of exhaust-steam into the atmosphere. It disappears with every molecule of water condensed or re-evaporated, whether in the cylinder, the jacket, or the boiler. It slips at every stroke through that excellent heat-carrier, the piston, from the hotter steam-side, to the colder exhaust-side of the cylinder. It pours, as "waste heat," up the chimney. It is reduced by every atom of atmospheric air admitted to the furnace over and above the quantity required for perfect combustion of the fuel, and it radiates from every square inch of exposed surface. These losses in the best engines may be distributed as follows:—seventy per cent. of the total heat-energy derived from the fuel, including that which is lost in "steam-making," is rejected in the exhaust-steam; twenty per cent. is lost by radiation, conduction, and faults of mechanism; and only the remaining ten per cent. is converted into mechanical effect.

Reverting now to the original question—"What are the relative merits of Simple and Compound engines?" it is evident that this enquiry may be better stated in another form; viz. "What leak, or leaks, of heat-energy in the simple engine can be stopped by compounding?"

It has been shown that expansive working in Simple engines results in losses by condensation and re-evaporation which, increasing with the rate of expansion, are only partially compensated by the use of the steam-jacket. The greater the difference between the temperature of the incoming and the outgoing steam in a cylinder, the greater the loss by cooling and consequent condensation. If, without sacrificing the advantages to be gained from its expansion, steam could enter and leave a cylinder without any reduction of its temperature, all losses due to condensation and re-evaporation would be avoided.

But no approximation to this state of things is possible in the simple engine, as best becomes apparent by an instance. Steam, entering the unjacketed cylinder of such an engine at a working pressure of 100 lbs., and a temperature, therefore, of 328°, is rejected into the air at a temperature of 212°, representing a drop of 116°, as between one end of the stroke and the other. The greater this fall in temperature, the greater the condensation and consequent re-evaporation taking place in the cylinder, processes which the steam-jacket (itself, be it remembered, a coal consumer), cannot entirely check. It is clear, under these circumstances, that some device is wanted

capable of diminishing the range of temperature in the cylinder.

The compound engine is such a device. Steam at the boiler pressure is first led into a small cylinder whence, after a moderate expansion, it exhausts into a larger cylinder, to be finally rejected into the air. At the presumed working pressure of 100 lbs., therefore, and with a cut off at half stroke, steam, entering the small cylinder at 328°, would leave it, in accordance with Marriotte's law, at a pressure of 50 lbs., and a corresponding temperature of 280°,—the total drop of temperature in the high-pressure cylinder, where, as will presently appear, the losses due to cooling are greatest, being only 48°. Similarly, steam entering the large cylinder at 50 lbs. pressure, and 280° temperature, is rejected into the air at a pressure of 15 lbs., and a temperature of 212°, representing a drop of 68°. The total range of temperature is, indeed, the same in both these instances, viz. 116°, but the cylinders of the compound engine have, each, a mean temperature much nearer that of the steam employed in them than is the case with the cylinder of the simple engine.

It is obvious from these considerations that a further advantage might be expected from leading the steam through a succession of cylinders for the purpose of minimising the fall of temperature in each. A step has already been taken in this direction by the construction of triple-cylinder compound engines, and it is probable that a still larger number of cylinders might be advantageously used in large steam-engines.

The leak of heat-energy which the Compound engine attempts to staunch has been discovered; it remains to enquire how much higher the ship will float after this leak has been stopped, or, in other words, "What percentage of advantage is there in Compound over Simple engines?"

Upon this question the Newcastle trials have thrown new light. Hitherto, the performance of a Compound engine by one builder has been too often compared with that of a Simple engine by another maker, without greatly advancing the solution of the question. But, during the late trials, simple and compound engines by the same, and highly competent, designers, have, for the first time, competed with each other under precisely similar conditions.

Three competitors, Messrs. Davey and Paxman, McLaren, and Foden, showed Simple and Compound engines at Newcastle, each of the very highest excellence, which, together, furnish a more conclusive answer to the question at issue than has ever before been obtained by the engineer. The following table exhibits the relative coal consumptions of these engines, and,

in itself, constitutes a complete and valuable reply to the enquiry proposed by the Royal Agricultural Society for solution :—

Maker.	Lbs. Coal per Brake-Horse-power per hour.		Difference.	Percentage of advantage in favour of compound system.
	Simple.	Compound.		
Davey, Paxman & Co. ..	2·6	1·85	·75	28·9 per cent.
Foden	2·76	1·94	·82	29·7 per cent.
McLaren	2·68	2·18	·50	18·6 per cent.

There is no doubt that McLaren's percentage of advantage would have been higher but for the fact (alluded to in the account of his trial) that his compound engine worked under unfavourable conditions.

It may be concluded that the introduction of compounding into portable engine practice would be followed by a saving of more than 25 per cent. in coal, comparison being made between engines of both types fitted with automatic expansion gear, while there can be no doubt that compound engines, without expansive gear of any kind, will surpass the above percentage of economy, comparison being made with existing portable engines, also without expansion gear.

With regard to the question of relative weight, involving the question of price, the following table gives the weights of the six engines already mentioned, viz. :—

Maker.	Weight in Tons.	
	Simple.	Compound.
Davey, Paxman & Co.	4·91	5·24
Foden (traction)	10·42	11·20
McLaren	5·04	5·46

The Compound engine weighs, at present, more than the simple engine, although requiring a boiler of considerably less steaming capacity. After further experience has given makers more confidence in the economy to be obtained from compounding, they may, perhaps, venture on pinching the dimensions of their boilers a little, and in this way compensate for the extra weight of a second cylinder and second valve chest. It is quite to the point to remark here that all the Compound-

engine boilers tried at Newcastle had more than ample steaming capacity.

A brief word must, finally, be said as to the *rationale* of high pressures, and their influence upon economy in the compound engine. It has already been shown that there is a fixed, although not regularly progressive, relation between the pressure and the temperature of steam. For example, steam at a pressure of 1 lb. per square inch has a temperature of 102°, while an increase of 25° in this temperature only raises the pressure by a single pound. On the other hand, a rise of 25° in the temperature of steam at a pressure of (say) 260 lbs. is accompanied by an increase of 80 lbs. in its pressure. Evidently, therefore, it is better policy on the part of the steam-engineer to spend his units of heat in the higher, rather than the lower ranges of temperature, the interest on capital, so to speak, being so much greater in one quarter than in the other.

But the advantage has corresponding drawbacks. The difficulty of the steam-engineer in regard to heat is, how, having got it, to keep it. Among such higher tensions as are now available in practice, a drop of ten degrees in temperature means a loss of 20 lbs. pressure, while a similar drop in the tensions in vogue only a few years ago involved a loss of only 8 lbs. pressure; so that condensation and re-evaporation are enemies, more than twice as dangerous now as formerly. It is of no use laying out heat-units prudently, and then squandering the proceeds in riotous condensation.

Happily, the Compound engine is no prodigal. Heat-energy, in the form of steam, is better trusted to the keeping of its cylinders, because their range of temperature is very much shorter than that of the cylinder in a Simple engine. To increase steam-pressure, and cut off still earlier in the Simple engine, with a view of rivalling the economy which follows upon compounding, only aggravates the evils from which this type of engine already suffers. A point may, indeed, be reached where all the economy derivable from greater expansion in a single cylinder is more than lost by the increased condensation and re-evaporation which follows upon its use. It is even probable that makers of compound portables will find it best to fix the point of cut-off in the small cylinder, for, this being well chosen, little further fuel economy will be gained from the use of a variable automatic expansion gear. Lastly, a very early cut-off in a single cylinder, using steam of high tension, means very unequal impulsion of the crank, and great inequalities in the strains thrown upon all the parts of the engine. With a fairly long admission, the shocks so caused are of little moment,

because they are moderated by the action of the fly-wheel, but if it were attempted to obtain an economy equal to that of the compound engine by the means under review, the inequalities of strain in question would become formidable.

The Trials.

The prizes offered were as follows:—

Class 1.—Portable agricultural engine, self-moving or otherwise, on the compound principle, not exceeding eight horse-power £200

Class 2.—Portable agricultural engine, self-moving or otherwise, on the simple principle, not exceeding eight horse-power £100

The brake trials of implements entered in Classes 1 and 2 will be designed to elucidate relative merit under the following head:—

Construction:—Efficiency—*i.e.*, proportion of actual work done to work indicated, economy of fuel, of steam, of lubricant, perfection of combustion, price.

The following engines were entered for trial:—

Class 1.—No. 3115—Thomas Cooper (self-moving).
" " 3124—Davey, Paxman and Co.
" " 3113—E. Foden and Sons (self-moving).
" " 3116—Edward Humphries.
" " 3107—J. and H. McLaren.

Class 2.—No. 3125—Davey, Paxman and Co.
" " 3114—E. Foden and Sons (self-moving).
" " 3117—Edward Humphries.
" " 3108—J. and H. McLaren.
" " 3111—The Alnwick Foundry Co.
" " 147—Jeffery, Blackstone and Co.

All these engines, with the exception of Jeffery & Blackstone's, a "vertical" of 3 horse-power, were entered as of *eight horse-power*. No restrictions as to the horse-power at which the engines were to be worked on the dynamometrical brake were imposed, but each exhibitor was invited to declare the horse-power, number of revolutions, and pressure of steam at which he proposed to run.

The conditions laid down for regulating the trials were practically the same as those which governed the Cardiff trials, the changes being unimportant, and the additions few. Among the changes, it was arranged that each engine should run for four hours, during which time it might go on calling for coal. Then, the coal supply was stopped, and any unused fuel weighed back, while the engine continued running until its revolutions fell below the declared speed. The additions, on the other hand, consisted in the collection and analysis of the smoke-box

gases, and in the measurement of the volume of air passing through the furnace.

Each engine was really subjected to three independent trials:—

(1.) *A Preliminary Run*, during which the time taken in raising steam from cold water, first to 60 lbs., and then to the working pressure, was noted; the exhibitor being, meanwhile, allowed to make any adjustments he pleased in his engine. These "Preliminary Runs," giving no data of importance, are not described in this Report.

(2.) *The Trial Run*, lasting four hours, or thereabouts; and determining economy, on the brake; and

(3.) *A Secondary Trial*, during which each engine was indicated, the governor control tested, the smoke-box gases analysed, and the amount of air passing through the furnace measured.

Powell's Duffryn coal was used on this occasion, the Llangennech Colliery, from which the Society has hitherto drawn its supplies for trials, being no longer in work. The Report on the Composition and Calorific Power of various Coals, forming a supplement to the Judges' Report of the Cardiff Engine Trials, places Powell's Duffryn coal ahead of all the Welsh steam coals for efficiency, and makes it slightly superior to Llangennech.

Each competitor, as on previous occasions, provided his own fireman, who was unassisted in the management of the engine during the trial run. A "tachometer," attached to the brake, saved a good deal of counting, and enabled Engineers and Judges to see at a glance whether the engine under trial was keeping a regular speed.

The leading dimensions of all the engines and boilers tried are given in the Tabular Statement of Results, prepared by the Society's Engineers, which accompanies their Report, and are therefore omitted from the general descriptions which follow, for the sake of avoiding needless repetitions.

The Trial Runs.

These commenced on Tuesday the 5th of July, the first engines got into position being those of the *Alnwick Foundry Company* and *Messrs. Davey Paxman and Company*, both of the Simple type. Of these, the latter made only a preliminary run on the day in question.

Simple Portable Engine by the Alnwick Foundry Company (No. 3111).—The exhibitor elected to run at a speed of 150 revolutions, a pressure of 80 lbs., with a brake-load of 16 horse-power.

This engine was understood to be a first essay on the part

of its builders, and, to use a colloquial expression, was an example of "how not to do it." The boiler is of the locomotive type, lagged with wood, and having the cylinder placed nearly centrally over the firebox, to which it is secured by means of angle irons, rivetted to the shell of the boiler. The crank brackets are of cast iron, and are also bolted to angle irons rivetted to the boiler. The crank is "bent," and placed very nearly centrally between the crank brackets, from which, therefore, it receives no close support. There are no stays between the cylinder and crank brackets. The slide valve is single and driven from a fixed eccentric. The cylinder has no steam-jacket, but is simply lagged with wood. There is no pump and no feed heater, the boiler being supplied with cold water by means of a Holden and Brooke Injector. The governor is small, of the cross-armed type, and runs slower than the engine, whose speed it did not regulate at all during the trial, while, generally, the engine was somewhat roughly made.

The manner in which this engine was fired was, of itself, evidence enough that the Alnwick Foundry Company are tyros in portable engine competitions. The speed, as pressure varied, was controlled by the regulator; the fire door was frequently wide open; while the boiler was fed by occasional gushes of cold water from the injector. It is not a matter for surprise that, under these circumstances, this engine, after running for 4 hours 5 minutes actual, and 4 hours 9 minutes mechanical time, had consumed 404 lbs. of coal or 6·47 lbs. of coal per horse-power per hour.

Davey Paxman and Company's Simple Engine (No. 3125).—This engine, tried on the morning of the 6th July, was very skilfully fired by Mr. Paxman himself, who elected to run at 132 revolutions and a pressure of 105 lbs., with a brake-load of 17 horse-power.

The boiler of this engine is of the locomotive type, but furnished with eight "Paxman" water tubes, which, springing from the sides of the fire-box, just above the grate, curve upwards to its crown. The boiler is of mild steel throughout, with drilled holes, and machine-rivetted. It was thickly lagged with hair-felt and wood, covered externally with sheet iron. The cylinder is placed, nearly centrally, over the fire-box, and, including the covers, is completely jacketed, the jacket draining into the boiler. The jacket is formed by putting a hard cast-iron liner into the outer casting. The crank brackets are of cast-iron, bolted in the usual way to the boiler-shell, and stayed to the cylinder itself on the crank side, and to the boiler-shell, just over the fire-box, on the fly-wheel side. The crank is "bent," and shouldered close to the bearing. The slipper-guides consist, each of two flat bars, bolted at their rear ends to the cylinder, and forward, to a bracket rising from the boiler. The valve gear consists of a main and cut-off slide valve, the latter deriving its motion from a link which is under control of the governor. Each end of the link is connected to an eccentric, one giving a late,

and the other a very early, cut-off, the latter amounting to complete suppression; the position of the link is itself controlled by the governor, which thus determines the length of the admission. The cut-off valve slides on a plate which, lying upon the main valve, loosely fits the steam chest. The plate is ported, the object being to keep a constant lead, and the ports themselves are twinned, thus halving the travel of the cut-off slide, and doubling the sensitiveness of the governor's control. The feed-pump is placed vertically under the crank-shaft and is continuous in its action; a cock in the delivery pipe determining how much water shall go to the boiler, and how much shall return, through a bye-pass, to the tub. The returning water meets with exhaust steam in the usual way, and reaches the tub, in company with the drainage of the water heater itself. This consists of a chamber, about 5 feet long, saddling the boiler, and flush with the lagging, which receives the exhaust steam on its way to the chimney. An inch copper pipe makes eight runs of this chamber, through all of which the feed water flows, finding its way afterwards into a coil of inch-pipe placed in the smoke-box. Lubrication of the cylinder is provided for by a "Beck" sight-feed lubricator, which worked very satisfactorily during the trial, while the connecting-rod head is oiled by a simple automatic wiping apparatus.

This engine ran for 4 hrs. 23 mins. of actual, and 4 hrs. 29½ mins. of mechanical time, with a supply of 193 lbs. of coal, equivalent to a consumption of 2·6 lbs. of coal per horse-power per hour; beating the best Cardiff record, of 2·79 lbs., and thus, early, leading every one interested in the trials to anticipate some remarkable results when the compound engines should make their appearance.

There is little to say about the general behaviour of the Davey-Paxman Simple engine during its trial. The steam pressure and speed hardly varied at all from start to finish, while the engine ran quietly and smoothly, requiring very little attention, the lubrication being, for the most part, automatic; and the governor controlling the speed absolutely.

Simple Engine by Mr. E. Humphries (No. 3117).—This was the second engine tried on the 6th of July, and constituted Mr. Humphries' first appearance as a competitor in the Royal Agricultural Society's Engine trials. Mr. Humphries' representative elected to run at a speed of 145 revolutions and a pressure of 85 lbs. with a brake-load of 16 horse-power.

The boiler is of the locomotive type, lagged with felt and wood. The cylinder is placed over, and somewhat to one side of, the fire-box, and, saving the covers, is jacketed, the jacket draining direct into the boiler. The slipper-guides consist each of two flat bars, bolted, at their rear ends, to the cylinder, and, forward, to a bracket rising from the boiler for the purpose of their support. The crank is "bent," and shouldered close up to the bearing. The crank brackets are of cast-iron, bolted to the boiler shell, and stayed, on the crank side, to the cylinder, on the fly-wheel side to the boiler shell, over the fire-box. The crank shaft bearings are divided vertically on the crank side, the take-up being provided for by a single set screw, while, on the fly-wheel side, there are three brasses, having vertical divisions, of which the bottom brass is set up by a wedge, and the lateral brasses by set screws. A special

arrangement is made whereby the plummer blocks may slide horizontally on a planed bed to permit of expansion. The valve gear consists of a single slide-valve, driven by an eccentric of variable travel, controlled by a Hartnell-Turner governor on the crank shaft. [This governor, now well known, was fully described and figured in the Report of the Cardiff trials, and needs, therefore, no further notice here.] The pump lies at an angle with the crank shaft, and the feed is heated by a neat bye-pass arrangement. Such feed water as does not go into the boiler returns to the tub, meeting, on its way, with a portion of the exhaust steam, the steam and water mingling in a conical annular chamber which, forming the termination of the exhaust branch-pipe, acts the part of an aspirator, and carries the surplus water, together with the water of condensation from the exhaust, back to the tub. This is a pretty arrangement first introduced, it is believed, by Messrs. Garrett of Leiston. There are two safety valves placed over the cylinder jacket and controlled by spring-balances. The chimney is raised and lowered by means of "Coultas' patent chimney-raiser," consisting of a small barrel, with winch and chain.

This engine was first declared to run at 16 brake-horse powers, and 130 revolutions ; but, the preliminary trial having demonstrated that the Hartnell-Turner governor could not keep the number of revolutions down to the declared limit, the revolutions were increased to 145, the brake load remaining unaltered. Similarly, the declared steam pressure was 85 lbs., but the engine over-ran so much at this pressure that, during the greater part of the trial, the pressure was kept down to 70 lbs. With 70 lbs. of steam, the engine ran fairly steadily at about 145 revolutions, but, with any variation in the load, there would have been, practically, no control of the speed.

The engine ran for 4 hrs. 1 min. actual, and 4 hrs. 2 mins. mechanical time, with a coal supply of 351 lbs., equal to a consumption of 5·11 lbs. of coal per horse-power per hour.

Simple Engine, by Messrs. Jeffery and Blackstone (No. 147).—This was the first engine to be tried on the 7th of July, and, belonging properly to quite another class than that of ordinary Agricultural Portable Engines, its performance, which was in no way remarkable, may be dismissed with a brief notice. The engine, nominally of 3-horse power, is of the vertical type, arranged for travelling.

A multitubular boiler is mounted on two travelling wheels and fitted with a pair of single-horse shafts, whose position, relatively to the upright boiler, is such, that the latter, when on the road, assumes an inclined position, the weight preponderating on the shaft side of the axle.

When at work, the shafts are removed, and the boiler, now in a vertical position, is steadied by three stay-legs, two forward and one aft, which certainly kept the machine very steady while under trial. The cylinder is placed below the crank-shaft and is not jacketed, while the valve gear consists of a single slide valve. A small governor, running slower than the engine operates a throttle valve for regulating the speed, and the pump draws and delivers cold water.

Neither the boiler nor cylinder were lagged, the exhibitors, apparently, not aiming at economy at all, but only to produce a rough-and-ready vertical engine of small power, easily prepared either for travelling or for work.

All the various parts constituting the engine are bracketed, by means of forgings, piecemeal, so to say, to the boiler, a plan of construction which renders each engine an independent organism, built up of parts, none of which are interchangeable, and depending for the accuracy with which its many pieces are assembled entirely on the skill of the smith and erector. In this respect, indeed, Messrs. Jeffery and Blackstone have taken a path the very opposite of that which is now generally followed by engineers.

The exhibitors declared to run at 160 revolutions and a pressure of 60 lbs. with a brake-load of $4\frac{1}{2}$ horse-power. The engine ran 4 hrs. 11 mins. actual and 4 hrs. 5 mins. brake time, using 113 lbs. of coal, a consumption equal to 7·11 lbs. of coal per horse-power per hour.

Compound Agricultural Self-Moving Engine, by Mr. Thomas Cooper (No. 3115).—On the 7th of July a trial was also made of Mr. Cooper's engine, which has many novel and interesting features. The name of Cooper is new in the field of agricultural engineering practice, and it is understood that this engine, made by Messrs. Garrett and Sons from Mr. Cooper's designs, is a first essay. If this be so, the results are most creditable to that gentleman's skill and ingenuity.

This engine, although a "roadster," and capable of hauling a load of some ten tons, has been designed chiefly for threshing; its self-moving qualities being matters of minor consideration. Lightness and simplicity have consequently been specially studied, with the result that the engine, although fitted with road-gear, weighs only five tons, and it is no more than six feet wide over all.

The boiler is of the locomotive type, with a parallel barrel throughout. The cylinders are placed forward on the boiler, and the crank shaft, towards, but not over, the firebox. Both cylinders are unjacketed, but lagged with felt and wood. The cranks are at right angles to each other, of "slab" construction, and shouldered close up to the bearings on either side. The slipper-guides are formed, each, by two flat steel bars bolted at their rear end to the cylinder and, forward, to a wrought-iron "spectacle" plate which, in turn, is carried by two main stays connecting the cylinders and crank brackets, the stay and bracket being forged in one piece and attached at the crank end to the boiler by means of angle irons. The crank brasses lie in their beds at an angle of 45°, and are correspondingly divided. The valve gear consists of a single slide valve to each cylinder, driven, each, by a single eccentric, without any provision for expansive working, and, equally, without reversing link motions.

In place of a link-motion for reversing, the eccentrics are forced round on

the shaft, by means of a gripping pall and lever, into the proper position for going ahead or astern; an arrangement which is represented as sufficient for all practical purposes, while involving less complication than a link-movement with its pair of eccentrics, &c.

The speed of the engine is controlled by a "Pickering" governor, placed horizontally, and acting upon a throttle-valve, but the control was not good during the trial.

The feed-pump lies at an angle of 45° with the crank shaft, and is secured to the water-tank, which is placed nearly centrally under the boiler. A portion of the exhaust steam is led through a $1\frac{1}{4}$-in. pipe into the water tank, and heats the feed water by surface contact. The water tank is fitted with a small "lifter" and hand-pump, either of which may be conveniently used for the purpose of filling it, although the office of the pump is chiefly to fill the boiler itself, or to furnish, with the aid of a short piece of hose having a nozzle, a strong jet of water for washing out the mud-holes of the firebox.

Self-movement is effected by means of a pitch-chain, similar in construction to that used, some years ago, in "Green's" lawn-mower, but made of thin plates of steel, of which 26 are placed side by side to form a link. It was stated that this chain bears easily a strain of 7 tons, while the greatest pull upon it when at work is $1\frac{1}{4}$ tons. The driving chain passes directly from a small chain pulley on the crank shaft to the main road wheel (which is connected with its fellow through the usual differential gear) without intermediate motions, and is put in or out of gear by a nut on the end of the shaft which controls a conical friction-clutch forming part of the chain pinion. Two idle rollers, supported on a pivoted arm, are employed in such a way that they take up the slack of the driving chain automatically, so that its pulling side is always straight, whether the engine is running backwards or forwards. The road wheels and steering gear need no special description, but are both of simple design, and good proportions. It is, however, worthy of remark that the front wheels can be locked right under the boiler, and the engine turned in its own length.

In the absence of any second, or "slow" speed, Mr. Cooper provides for such extra calls as may occasionally be made on the tractive power of his engine by admitting boiler-steam to the large cylinder whenever required. The starting valve is so arranged that when its lever stands in a central position, steam is shut off altogether; when pulled towards the driver, the small cylinder only is supplied; while, when pushed as far as it will go past the midway "stopping" point, another set of ports is opened, which admit steam to both cylinders.

Mr. Cooper's engine is, altogether, very well designed and made. It exhibits a great deal of originality of the practical and not of the "faddy" type. Being in no sense a "racer," it could not be expected to figure in the first flight with more economical engines, but its performance was most creditable, and formed a specially interesting feature of this competition, since it furnished an example of what may be expected from the general introduction of compound engines of the "commercial" type.

Mr. Cooper elected to run at 170 revolutions, and at a pressure of 125 lbs. with a brake load of 18-horse-power. During the preliminary trial, which was made with a brake load of 17-horse-power, the engine was stopped more than once to adjust the

governors, and before starting on his final run, the exhibitor changed his brake load to 18 horses, leaving his speed unaltered. In the trial run, the engine worked steadily, keeping its speed fairly well with a steady load, but was not properly under the control of the governor. The crank of the high-pressure cylinder became unduly heated towards the end of the run, and oil was lavishly used throughout the trial.

The engine ran 4 hrs. 5 min. actual, and 4 hrs. 9 min. mechanical time, with a coal supply of 259 lbs., or 3·67 lbs. of coal per horse-power per hour—a very interesting result, as showing what can be done by a compound non-condensing engine, working at the moderate pressure of 125 lbs., and having no expansion slides.

Compound Portable Engine, by Messrs. Davey Paxman and Co. (No. 3124).—This engine, which came to the brake on the 8th of July, naturally excited much interest and attention after the exceptional performance of the Paxman Simple Engine, tried on the 6th.

The two engines differ from each other, materially, in construction. In the former, the various parts of the engine are bolted to the boiler in the usual way, while, in the latter, these parts are carried upon a wrought-iron "bed-plate," which is entirely independent of the boiler, except for its support.

The boiler is of the locomotive type, with a parallel barrel, but is not provided with any Paxman tubes in the fire-box. It is made, like that of the Simple Engine, of mild steel throughout, with drilled holes, and is machine riveted. The "bed-plate" of the engine consists of two longitudinal channel-irons, planed on their upper surface, cross-connected by the cylinders themselves at one end, and at the other by a wide piece of boiler plate, planed, and supporting the crank bearings. The plate is cut out, where required, to permit the revolution of the cranks. A third cross-piece, of cast iron, serves to support the rear ends of the slipper-guides, the slide-spindle guides, and the governor; while a fourth cross-piece, also of cast iron, supports the forward ends of the slipper-guides. The "bed-plate" is, itself, carried by four horn-plates, rising from the boiler, and securely riveted to it. By this arrangement it is claimed that the expansion of the boiler (greater as the pressure and temperature of the steam is higher) is provided against, while the boiler is not pierced and weakened by any unnecessary holes.

The cylinders, together with their covers, are both completely jacketed and lagged, while the jackets are drained, by means of pipes, into the boiler. The valve gear and governor are exactly like those of the Paxman Simple Engine, already described, and the "cut off" is controlled in a similar manner. The pump and feed-heater are also like those of the Simple Engine, but there is no coil in the smoke-box. The cranks are at right angles to each other, of "slab" construction, and the crank-shaft is provided with a third, central, crank bearing, all being of considerable length, divided and adjustable as in the other engine. The cylinder is provided with a "Beck" sight-feed lubricator, and the head of the connecting-rod with an automatic oiling gear similar to that already described.

Mr. Paxman elected to run at 134 revolutions, with a pressure of 150 lbs., and a brake-load of 20-horse power. Nothing worthy of remark occurred during the trial run, which was characterized by perfect smoothness of working and great regularity of speed; the governor having perfect control of the engine. Mr. Paxman himself again fired, exhibiting the same finished skill as in his previous trial.

Quite a crowd of experts and others interested in the competition filled the shed towards the end of this trial, when, amidst some excitement, it began to be understood that the run would undoubtedly prove a phenomenal one. At the end of the prescribed four hours, and doing a duty of 20 horses, Mr. Paxman had only called for 168 lbs. of coal, while, on the coal supply being stopped, and none of his ashes yet used, it was evident that the "run down" would be a long one. Finally, the engine was stopped at 4 hrs. 28 min. actual, and 4 hrs. 39¾ min. mechanical time, the coal used being 168 lbs., equal to a consumption of only 1·85 lbs. of coal per horse-power per hour.

This remarkable performance, although somewhat of a "staggerer," seemed neither to depress the spirits of other exhibitors of compound engines, nor diminish the hope of such experts as had been busily inspecting drawings, that other runs of at least equal merit would yet be made. So that Saturday was looked forward to with the highest possible interest.

Compound Portable Engine, by Mr. Edward Humphries (No. 3116).—This was the second engine tested on Friday, the 8th, the trial run proving a disappointment.

The boiler is of the locomotive type, and exactly similar to that of his Simple engine. The cylinders are mounted over the fire-box, and, saving the covers, are jacketed and lagged, the drainage of the jackets going direct to the boiler. The slipper-guides are cylindrical, forming part of the cylinder cover in each case, and bored out. The crank brackets are of cast-iron, bolted to the boiler in the usual way. The cranks are of steel, "bent," and placed at an angle of 180° to each other, the steam from one end of the small cylinder exhausting direct into the opposite end of the large cylinder, as in the well-known "Woolf" arrangement. The shouldering of the crank-shaft to its bearings is some inches from the cranks themselves. There are no stays between the cylinder and crank-shaft bearings, or any slide for the latter, as in Humphries' Simple Engine, the opposition of the cranks, it was explained, rendering this provision unnecessary.

The valve gear consists of three slides, of which the first admits steam to the small cylinder, the second exhausts from the small cylinder and admits to the large cylinder, while the third exhausts from the large cylinder. Slide No. 1 is driven from its own fixed eccentric, but slides Nos. 2 and 3 are operated by an eccentric common to them both. The rate of expansion is fixed, and the speed of the engine is controlled by a small high-speed "Porter" governor, acting upon a throttle-valve. The pump, exhaust-heating apparatus, and the remainder of this engine generally, are all similar to the Simple engine which has already been described.

Mr. Humphries elected to run at 185 revolutions, and 100 lbs. pressure, and with a brake-load of 20-horse-power. From the first, it was evident that this engine was under no proper control by the governor, and its speed during the trial was, indeed, practically governed by the driver and regulator handle.

After running for $2\frac{1}{2}$ hours, during which time the calls for coal were heavy, the engine was stopped at the suggestion of the exhibitor, who recognized the uselessness of continuing the contest. The engine ran 2 hrs. 26 min. actual, and 2 hrs. 23 min. mechanical time, using 249 lbs. of coal, equivalent to a consumption of 5·5 lbs. per horse-power per hour.

The indicator diagrams taken from this engine during the secondary trial, given elsewhere, must be consulted in explanation of a performance which was the more disappointing, inasmuch as the engine was of simple design, good proportions, and well made.

Compound Traction Engine, by Messrs. Foden and Sons (No. 3113).—The trial of this engine, which took place on Saturday the 9th, excited special interest, on the twofold grounds that it was expected to run the Davey-Paxman Compound very close, while the declared steam-pressure of 250 lbs. per square inch was far in excess of that used by any other exhibitor, and questionably, either within or without the limits which practice must somewhere impose on very high tensions.

The boiler is of the locomotive type, with a parallel barrel. The cylinders are placed at the smoke-box end, and, including the covers, are completely jacketed, the jackets draining into the boiler. The slipper-guides are of cylindrical section, cast on the cylinder covers, and bored out. The cranks make an angle of 180° the one with the other, and consist each of a pair of discs, connected by a crank-pin; the discs, crank-pins, and crank-shaft itself being formed of a single steel casting.

The crank-shaft bearings are carried in a cast-iron box, which saddles the boiler at the fire-box end, and is supported by horn-plates, rising from the boiler. The crank brasses are divided at an angle of 45° and adjusted by means of lateral set-screws. The central portion of the crank-shaft, lying between the cranks, acts as a pulley for driving the governor, while, between the cranks and crank-bearings on either side, room is found for two eccentrics, giving motion to the reversing links. The valve gear of the small cylinder is of the kind known as "Farcot's," the main valve carrying the cut-off valve on its back by frictional contact, until the motion of the latter is arrested by coming into contact with suitable stops, either movable or fixed. These stops, in the present case, consist of the two ends of a slot, formed in the valve spindle, through which opening a wedge-shaped slide, operated by a high speed "Porter" governor, rises or falls with every change in the speed. The lower the wedge, the earlier the suppression of steam, and *vice versâ*. Since, however, the friction of the valve-spindle gland might possibly arrest the motion of the cut-off slide, a second stuffing box, made fast to the spindle of the main valve, grasps the spindle in question, balancing, by its own friction, the friction of the gland whose retarding agency is to be feared. Similarly, the outward pressure of the steam upon the end of the cut-off

valve spindle itself is balanced by spiral springs, acting through a cross-head, and in a direction opposite to that of the steam pressure, upon the spindle in question.

A positive motion would, of course, be preferable to an arrangement needing so many safeguards, but the "Farcot" cut-off lends itself to the necessity of reversing—a *sine quâ non* in a traction engine; and this is, presumably, the reason for its adoption by Mr. Foden. The high and low pressure cylinders have each a separate link-motion and reversing lever, so that the cut-off in the large cylinder can be adjusted independently of the "Farcot" cut-off in the small cylinder, while, on the road, the two levers can be coupled so as to act together.

There are two water-tanks, one situated under the barrel of the boiler, the other under the foot-plate. The former tank acts the part of a feed-tub, receiving the condensed water from the heater, but, instead of a bye-pass arrangement, the suction pipe, which draws from the tank in question, is provided with a cock to regulate the supply. The pump delivers into an inch pipe which makes four runs of a chamber occupying nearly half the forward length of the boiler, and finally travels through a coil of seven turns (or about 43 feet length of 1-inch pipe) placed in the smoke-box. A portion of the exhaust steam is further led back to the service-tank under the foot-plate, making it hot for the stoker, but contributing, with the remainder of the arrangements described, to supply a very hot feed.

The engine, as exhibited, had only one road speed of 27 to 1, but could be fitted with a quicker gear of 16 to 1. The axle of the travelling wheel, together with the gearing, is carried on helical springs, upon which the weight may be thrown, or from which it may be removed, at pleasure. The travelling wheels have all cast-iron tires and hubs, with splayed spokes of flat wrought-iron, while a small chain barrel, hauling upon locking chains, and operated by a worm wheel, forms the steering gear.

When required, steam can be admitted to the low-pressure as well as the high-pressure cylinder, by an arrangement which was described and figured on page 541 of the last volume of the 'Journal.'

Instead of an ash-pan damper, the chimney is provided with a sheet-iron throttle-valve, probably the best place, in a trial, to check the draft, inasmuch as it affords the driver an opportunity of closing the chimney aperture at the moment of opening the fire-door for the purpose of firing.

Mr. Foden elected to run at a speed of 156 revolutions, and a pressure of 250 lbs., with a brake-load of 18-horse-power. The engine was fired by one of his sons, who, though a lad in

age, exhibited great skill and coolness in his work. During the trial, the governor "hunted" a good deal, in spite of the fact that a rough equivalent for a dashpot, in the shape of a spring pin pressing upon a double inclined slot in the governor spindle was employed. The result upon consumption was, however, apparently trifling. Apart from the "hunting" of the governor, the engine worked smoothly and regularly, without any heating throughout the trial.

It speaks well for the workmanship of Mr. Foden's engine that, in spite of the very high steam pressure employed, no sign of a leak was anywhere visible; whether from engine or boiler, not a breath of steam issuing, even from a stuffing box. It is further worthy of remark that Mr. Foden has not adopted the sight-feed lubricator, but trusts to the ordinary forms of lubricators, notwithstanding the pressure and heat of his steam.

This engine ran for 4 hours and 21 minutes actual, and 4 hours $27\frac{1}{2}$ minutes mechanical time, with a coal supply of $148\frac{1}{2}$ lbs., equal to a consumption of 1·94 lbs. of coal per horse-power per hour.

The weight of the engine was ascertained to be 11·20 tons when empty. This is more than a ton over the weight which, had weight limits formed one of the conditions of trial, the Society would have imposed, and it may not be out of place to remark that the weight of the engine, conspicuously painted on its fore carriage, was considerably below that indicated by the weighbridge.

Simple Engine, by Messrs. J. and H. McLaren (No. 3108).—This was the second engine tested on Saturday the 9th, and, a close run between it and the Davey-Paxman Simple Engine being expected, there was, again, considerable interest excited by the trial.

The engine has a boiler of the locomotive type, with a parallel barrel. The cylinder is placed over the fire-box, and a little out of centre. The cylinder and covers are completely jacketed and lagged, the jacket draining into the boiler. The piston-rod and slide-spindles are of steel, while the slipper consists of a steel casting. The slipper-guides are, each, of two flat wrought-iron bars, bolted to the cylinder and a bracket, at either end, respectively. The crank is "bent," and of steel, shouldered close up to the crank bearings, which are carried by wrought-iron horn-plates riveted to the boiler by angle irons. A strong stay connects each crank-shaft bearing with the cylinder on one side, and the steam-jacket on the other. The crank brasses are divided vertically and adjusted by set-screws.

The valve gear consists of a main and cut-off slide, the latter controlled by a Hartnell-Turner governor, which, by determining the moment of suppression, regulates the speed of the engine. The Hartnell-Turner governor, as already mentioned, has been fully described in a past number of the 'Journal.'

The pump stands vertically below the crank-shaft and draws constantly from the tub, having a bye-pass for the return of unused water in the usual way. It delivers into a heater, which consists of a wrought-iron pipe, about

6 feet long and 6 inches diameter, closed at each end by a cast-iron chamber having radial divisions. Six copper pipes, $1\frac{1}{4}$ inch diameter, run from end to end of the heater, their extremities being jointed to the radial divisions of the terminal chambers in such a way as to constitute them, together, a continuous coil; while each copper tube has a spiral twist given it to allow of expansion. The exhaust-pipe passes right through the heater, which it enters through a stuffing box, to allow of expansion. Openings in the exhaust-pipe give exit into the heater of a portion of the exhaust steam sufficient to heat the feed-water.

The exhibitors elected to run at 130 revolutions, and 135 lbs. pressure, with a brake-load of 17-horse-power. Mr. Henry McLaren fired the engine, and exhibited a combination of *sangfroid* and skill, which challenged admiration again and again, as certain "troubles" developed themselves in the course of the run. The engine had scarcely started when a screaming noise, referred to the governor, declared itself. A little worried, no doubt, by the circumstance, but outwardly unmoved, Mr. McLaren did not discover, until the run had lasted for nearly an hour and a half, that his regulator handle was not fully open. Scarcely had he rectified this, when the "scream" became a loud "knock" and the engine slowed. Stopping at 12·10, it was found that the Hartnell-Turner governor had moved round on the shaft, the effect being to shift the expansion eccentric and upset the setting of the slide. This resulted from a piece of pure carelessness in the shop With a view to occasional reversing, the governor was furnished with a slot which had been cut the wrong way. As a consequence, the bolt, whose proper office was merely to secure the governor, either in the forward or back position, became a driver, getting loose after a time with the results already mentioned. Eight minutes were spent in putting matters right, and added accordingly to the length of the run, the engine starting again at 12·18. From the moment of restarting, she became quiet and regular in action, although it was evident that the control of the Hartnell-Turner governor was not perfect. But Mr. McLaren, in spite of many demands on his attention, kept his steam pressure so even that, the load being constant, this was very little noticeable.

Mishaps notwithstanding, this engine made a run of 4 hrs. 23 min. actual, and 4 hrs. $34\frac{3}{4}$ min. mechanical time, with a coal supply of $199\frac{3}{4}$ lbs., equal to a consumption of 2·68 lbs. per horse-power per hour.

Compound Portable Engine by Messrs. J. and H. McLaren (No. 3107).—This came to the brake on Monday morning the 11th, or at a moment when Davey Paxman's and Foden's Compounds had nearly tied in respect of consumption, while the former maker had, as nearly as possible, tied with McLaren in

the Simple Engine Class. How would matters stand when McLaren's Compound and Foden's Simple Engine had done their work on Monday night? It was an interesting, and, for the competitors, exciting question.

There is no need to speak at any length of Messrs. McLaren's Compound, which, saving in the use of two cylinders instead of one, is identical with the Simple Engine by the same makers already described, only the high-pressure cylinder being provided with a cut-off slide, which, as in the Simple engine, is controlled by a Hartnell-Turner governor.

The exhibitors elected to run at 135 revolutions, and a pressure of 155 lbs., with a brake-load of 20-horse-power, Mr. Henry McLaren again acting as fireman.

Before the trial run had begun a leak declared itself, which made it necessary to remove the cover of the high-pressure cylinder, and to plug with wood a half-inch hole through which the jacket of the cover itself was supplied with steam.

During the run, another "difficulty" occurred. The "Crosby" sight-feed lubricator partially failed of its office, with the result that the slide-valve of the small cylinder "seized" and caused its eccentric strap to heat badly. Mr. McLaren plied his oil-can vigorously, but without avail; the eccentric strap was hot, and growing hotter. Some fire-box stays, too, were dripping during the trial; so that when the run terminated, it is not to be wondered at that the Paxman Compound performance remained unbeaten.

This engine ran 4 hrs. 24 min. actual, and 4 hrs. $51\frac{1}{2}$ min. mechanical time, taking a supply of $202\frac{1}{2}$ lbs. of coal, equal to a consumption of 2·18 lbs. of coal per horse-power per hour.

Simple Traction Engine, by Messrs. Edward Foden & Sons (No. 3114).—This engine, the last on the list, was tried on Monday the 11th, simultaneously with McLaren's Compound. During its preliminary run some adjustment of the "Farcot" valve required to be made, but all was in order when the trial run commenced.

Foden's Simple Engine is practically a duplicate of his Compound Engine, which has already been fully described. The exhibitor elected to run at a speed of 168 revolutions and a pressure of 120 lbs., with a break-load of 12 horse-power, rather a light load for an engine of such dimensions. The governor "hunted" somewhat during the trial, as in the case of the Compound Engine, but the engine ran smoothly and steadily, in spite of a somewhat too sensitive control. It made 4 hrs. $23\frac{1}{2}$ min. actual, and 4 hrs. 30 min. mechanical time, with a coal supply of $138\frac{1}{4}$ lbs., equal to a consumption of 2·76 lbs. of coal per horse-power per hour.

In what precedes, only the coal consumption of the engines under trial has been recorded, whereas, if any discrimination is to be made between engine-economy and boiler-economy, it is needful to know how much steam each engine used per horse-power per hour, and how much steam its boiler made for every pound of coal consumed.

It is quite conceivable, for instance, that a boiler capable of evaporating 12 lbs. of water per lb. of coal, may be saddled with an engine needing 36 lbs. of steam per horse-power per hour; while another, capable of making only 10 lbs. of steam per lb. of coal, may carry an engine requiring 30 lbs. of steam per horse-power per hour. Three pounds of coal per horse-power per hour would be consumed in both these cases, while, if the respective engines and boilers changed places, one engine would burn 3·6 lbs. of coal per horse-power per hour, while the other would only burn 2·5 lbs. of coal per horse-power per hour.

The *total* water consumption of each engine, which, for reasons given at length in the Engineers' Report, cannot be stated with the same accuracy as its coal consumption, was ascertained in the following way.

The water actually supplied to the feed-tub was measured in each case. The temperature of such *supplied* water, together with the temperature of the feed-water, was ascertained, and the difference between these temperatures being the work of the exhaust steam, the weight of such steam requiring to be condensed in order to raise the temperature of the measured "supply" water to the temperature of the hot "feed" water was ascertained and added to the weight of *supplied* water. Finally, the condensation in the jackets, not being measurable, was estimated from data furnished by experiments upon engines in which such condensation was measurable, and the weight of jacket-water, so ascertained, was added to the sum in question.

It will be noticed that, taking the two classes of engines into account, some used more than twice as much water as others, and, apart altogether from the question of the coal bill, this is a matter of the utmost importance. The water supply of farms is often scanty, and, almost always, distant from the points where motive power is needed. In the case of traction and ploughing engines, particularly, that motor is best which, besides being economical of coals, puts the least strain upon the water cart.

The Secondary Trials.

These consisted chiefly, as already stated, in indicating the various engines, and in the collection and analysis of the smoke-box gases. Efforts were also made to measure, by

means of the anemometer, the volume of air passing through each furnace, but the results of these experiments are unimportant in view of the completer information with regard to combustion afforded by analysis of the smoke-box gases. Of this, and the apparatus by which it was effected, full particulars will be found in the Engineers' Report, which also includes the Indicator Diagrams taken from the engines.

As the result of the Trials, the Judges awarded the prize of 200*l.* to Messrs. Davey, Paxman & Co. for their Compound Portable Agricultural Engine (Art. 3124), and the prize of 100*l.* to the same firm for their Simple Portable Agricultural Engine (Art. 3125).

In concluding this Report, the Judges desire to thank all the Exhibitors for the ready attention which they accorded to every suggestion, and the Stewards of the Society, their Consulting Engineers, the Engineering Staff, as well as the Analysts, for much valuable aid, and great courtesy in rendering it.

XXIX.—*Report of the Consulting Engineers on the Trials of Portable Agricultural Steam Engines, self-moving or otherwise, at Newcastle.* By SIR FREDK. J. BRAMWELL, M.Inst.C.E., F.R.S., and W. ANDERSON, M.Inst. C.E.

NOTWITHSTANDING the fulness of the Report drawn up by the Judges, we have deemed it necessary to prepare one dealing with matters not included in it, and in doing so, we inevitably trench upon subjects already discussed. To a certain extent, therefore, the two reports overlap, and there is repetition; we regret this, but it would have been impossible for us in any other way to make our report consecutive.

The object of our work is to exhibit and consider some of the leading facts connected with economy in fuel and in water, pointing out the relations between the results actually obtained, and the results theoretically obtainable; distinguishing between those cases where there is some room for practical improvement and those other cases where, until new metals or materials are met with competent to stand the needed temperatures that must prevail in a theoretically perfect engine, the engineer must be content with the production of work still far removed from ideal perfection.

Duty of the Boiler.

Economy in the quantity of water needed by a portable engine, in relation to the power produced, is a question second in importance only to that of the economy of fuel.

The supply of water to engines driving threshing machines in the field, or used for ploughing, commonly involves the expense and labour of cartage, and in the case of traction engines necessitates either the carriage of a heavy weight of water on the engine itself, the tank being made of large size, or involves the risk, should no brook or well be at hand, that the engine may be brought to a standstill on the road for want of water. Even when the well or brook is met with, there is needed the labour of pumping, or of otherwise raising the water into the tank of the engine.

Considering a portable or a traction engine as a whole, the economy of water in relation to the power produced obviously depends solely on the efficiency of the engine; while that of the fuel depends not only on this efficiency, but also on that of the boiler. The merits of a boiler may be entirely nullified by the defects of the engine which uses the steam: while the merits of an engine may be rendered unapparent by reason of the unsatisfactory nature of the boiler which supplies the steam consumed by that engine. Therefore, although the prizes are given for the boiler and engine as a whole, it is desirable, in order to obtain for mechanical science the full value to be derived from the "engine trials" of the Royal Agricultural Society, that the performances of the boilers, and of the engines, should be investigated separately.

A well-designed engine has its boiler fed from three sources: 1stly, from the water obtained from some source of supply—which water corresponds to the quantity of steam puffed away from the chimney; 2ndly, from the portion of the exhaust-steam which is condensed in heating the feed-water; and, 3rdly, from the water produced by the condensation in the steam jackets which surround the cylinder. In the trials here recorded, the water obtained from without was measured directly. In those engines which used their waste steam to heat the feed-water, the quantity of steam condensed in so doing has been calculated from the observed rise in temperature of the known quantity of fresh water supplied, and the results may be looked upon as approximately accurate. The quantity of steam condensed in the steam jackets cannot, however, be ascertained with a similar approach to certainty, because the jackets were in all cases connected directly with the boilers, so that no actual measurement could be made. It is certain, nevertheless, that the condensation in the

jackets bears some relation to the amount of work done in the cylinder, and to the rate of expansion. In large condensing engines, in which the circulation of steam in the jackets is thoroughly efficient, and where the rates of expansion are high, it has been found that the heat corresponding to the steam condensed represents very nearly the amount of heat converted into work. Though we have no experimental proof of the extent to which this law applies to small non-condensing engines, yet the assumption that it does so is a rational one, and we have therefore added the calculated weight of water so condensed in order to get an approximately correct estimate of the evaporative duty of the boilers. There can, at any rate, be no doubt, that with the very perfectly arranged jackets in use, and with the considerable expansion employed, that duty will be determined with a nearer approach to accuracy by making the proposed allowance for jacket-water than would be attained were no account whatever taken thereof.

We may illustrate the nature of the calculations by reference to Mr. E. Foden's "Simple" traction engine, No. 3114. During the trial run, which lasted $263\frac{1}{2}$ minutes, $138\frac{1}{4}$ lbs. of coal were consumed, and a total of 1413 lbs. of water at 63° were supplied to the engine. The condensed exhaust-steam raised the temperature of this water from 63° to an average of 83·6°, or 20·6°. We may assume that the exhaust-steam in the heater was about 1 lb. per square inch above the atmospheric pressure, and under such circumstances the total heat above the freezing-point per 1 lb. weight of steam condensed would be 1147·2 units. The steam was condensed at 83·6°, or 51·6° above the freezing-point; hence the number of units imparted to the water supplied per 1 lb. weight of steam condensed would be 1147·2 − 51·6 = 1095·6° units. The temperature of the 1413 lbs. of fresh water supplied rose 20·6°, which represented the absorption of 29,107·8 units, and therefore, dividing by 1095·6 units, we get 26·57 lbs. of steam condensed in heating the feed-water, and consequently the total quantity pumped into the boiler was 1413 lbs. + 26·57 lbs. = 1439·57 lbs.

But in order to compare the work done by different boilers, it is necessary to reduce the water evaporated to a standard temperature and pressure, because the quantity of heat which must be imparted to generate steam depends on these two points.

The standard usually adopted is the quantity of heat needed to evaporate water at the boiling-point, or 212° temperature, in an open boiler at atmospheric pressure. It requires 966·6 units of heat to evaporate one pound of water under these conditions. If water be supplied at a lower temperature than 212°, the heat necessary to raise it to that temperature must be added.

In the case under consideration, the water was pumped in at $83 \cdot 6°$, or $128 \cdot 4°$ below $212°$; hence $128 \cdot 4$ units of heat have to be added to $966 \cdot 6$, making 1095 units in all, and the quantity of water which would have been evaporated, had it been supplied at $212°$, would be increased in the proportion of 1095 to $966 \cdot 6$, that is $\frac{1439 \cdot 57 \text{ lbs.} \times 1095}{966 \cdot 6} = 1630 \cdot 8$ lbs. Dividing this quantity by the $138 \cdot 25$ lbs. of coal used, we have, omitting for the moment the jacket question, the evaporative power of the boiler represented by $11 \cdot 79$ lbs. of water from and at $212°$ per 1 lb. of coal.

With respect to the jacket question, the indicated horse-power developed was $13 \cdot 88$, consequently the units of heat converted into work per minute were $= \frac{13 \cdot 88 \text{ H.P.} \times 33{,}000 \text{ foot-lbs.}}{772^{J}} =$ $593 \cdot 3$ units. The steam in the boiler and jackets was at 120 lbs. pressure per square inch, and therefore at $350°$ temperature above zero Fahr., and the number of units of heat per 1 lb. of steam condensed at the same temperature would be $870 \cdot 9$. The run lasted $263\frac{1}{2}$ minutes, hence the total quantity of steam condensed in the jackets was $= \frac{593 \cdot 3 \text{ units} \times 263 \cdot 5 \text{ minutes}}{870 \cdot 9 \text{ units}} = 179 \cdot 5$ lbs. But this quantity must also be reduced to the standard temperature and pressure, and since it requires only $870 \cdot 9$ units to convert water at $350°$ into steam at 120 lbs. pressure, while it needs $966 \cdot 6$ units to evaporate from and at $212°$, it follows that $179 \cdot 5$ lbs. must be reduced in the ratio of $870 \cdot 9$ to $966 \cdot 6$, which makes it $161 \cdot 7$ lbs. The utmost that the boiler evaporated, therefore, was $1630 \cdot 8$ lbs. + $161 \cdot 7$ lbs., or $1792 \cdot 5$ lbs. from and at $212°$ by the combustion of $138 \cdot 25$ lbs. of coal, being at the rate of $12 \cdot 96$ lbs. of water to 1 lb. of coal.

Table III., on page 724, exhibits the results of the calculations relating to ten out of the eleven engines tried.

Efficiency of Boilers and Engines—Trials on the Brake.

The brakes used were the same as those which were employed at Cardiff. They were very carefully adjusted, and the brake-straps were accurately balanced when in the position they would occupy while running. It was decided to apply at these trials a correction for the friction of the brakes themselves and of their coupling shafts, a refinement which had never before been attempted. A rough approximation to the needed allowance was made before the trials by ascertaining what weight hung on the periphery of the brake-wheels would make them revolve slowly; but after the trials were over.

No. 1 brake with its tachometer was placed in an elevated position, a pulley $36\frac{3}{4}$ inch in circumference was keyed on to the shaft in lieu of the coupling, a cord was wound round the pulley, and the brake was caused to revolve by means of weights hung on till a load was found under which steady motion was maintained. In this way it was ascertained that, after a preliminary push or start was given to the wheel, 13 lbs. produced a decided acceleration, while 12 lbs. were incompetent to keep the wheel turning; hence, the resistance of friction was about $12\frac{1}{2}$ lbs. acting on a pulley 37 inches circumference to the centre of the cord. The weight revolving was 756 lbs., the total weight was, therefore, 756 lbs. + the $12\frac{1}{2} = 768\frac{1}{2}$ lbs. The journals of the brake shaft are $2\frac{1}{2}$ inches diameter, consequently the coefficient of friction comes out ·0766, which is about the usual figure accepted for the friction of shafts.

The circumference of the circle in which the point of attachment of the brake-load occurs is 17·3 feet, subject to trifling variation arising from the wear of the blocks, which variation is apparent in Table IV. (p. 725). The weight of No. 1 brake-wheel, shaft, strap, and coupling shaft, is 946 lbs., so that the weight corresponding to the friction of the apparatus, if placed in the scale-pan, would be,

$$= \frac{12\cdot 5 \text{ lbs.} \times 37 \text{ inch} \times 946 \text{ lbs.}}{17\cdot 3 \text{ feet} \times 12 \text{ inch} \times 768\cdot 5 \text{ lbs.}} = 2\cdot 74 \text{ lbs.},$$

being in round numbers ·003 of the weight of the revolving parts and brake-strap. The scale-pan weighs $8\frac{1}{2}$ lbs., which is increased to 8·525 lbs. when the friction due to its weight is added to it, and 946 lbs. $\times$ ·003 = 2·838 lbs. friction due to the whole weight of the brake, making 11·363 lbs. of permanent load at the scale-pan. Calling the load to be placed in the scale-pan W, its effective weight, adding friction, will be 1·003 W. Then if C be the circumference of the circle to which the weight hangs, and R the number of revolutions per minute, the brake horse-power of No. 1 brake will be

$$= \frac{(1\cdot 003\ W + 11\cdot 363) \times C \times R}{33000}.$$

The other two brakes have corresponding formulæ, differing only in the constant 11·363, on account of the different weights of the various parts.

An addition of considerable value was made by fitting the brakes with Thorne's electrical speed-indicators or "Tachometers." These instruments indicated on a large graduated dial, not only the speed at which the engines were running at any moment, but also the variations of speed during each revolution, the index-hand oscillating more or less accord-

ing as the motion during each revolution was irregular or was steady. The tachometers were very useful to the drivers in indicating a rise or fall in speed, and the Judges were by their aid able to form precise opinions on the merits of the governors and on the conditions of balance of the engines.

During the trials a question was raised by some of the spectators as to the additional load thrown on the brakes by the water pouring on them to keep them cool. It was argued that setting the water into motion and flinging it off at a high velocity would absorb an appreciable amount of power. The value of this objection, in the worst case, is easily calculated.

Supposing the whole of the water flung off at the full velocity of the periphery of the brake-wheel (which is 17 feet in circumference), at 150 revolutions per minute, then each pound of water would have a velocity of 42·5 feet a second communicated to it, and its energy would be $\frac{42 \cdot 5^2}{64 \cdot 4} = 28$ foot-pounds. The actual flow of water was 4·4 lbs. per minute, so that the additional work thrown on the brake was 123 foot-pounds per minute, and as the load circle ran 2595 feet per minute, it follows that the additional load in the scale-pan would be $\frac{\text{123 foot-lbs.}}{\text{2595 feet}} = \cdot 047$ lbs., or $\frac{3}{4}$ oz.

But the greater part of the water fell off without attaining any considerable velocity, so that it may safely be said that the water used in cooling the brakes did not add any appreciable load to the engines.

In order to facilitate comparison with the trials made at Cardiff in 1872, the brake horse-power has been worked out without the corrections for friction as well as with it. The figures originally given on the trial ground at Newcastle are not quite correct, the resistance of friction having been estimated too highly, but no error arose as to the comparative results, because all the brakes were subject to the same degree of error.

The fuel consumed per brake horse-power has also been calculated with and without correction for brake-friction, and, in addition, in order to make the results comparable with Cardiff, a correction has been introduced for the slightly superior quality of the Powell's Duffryn coal used. The Llangennech coal hitherto employed in the Society's trials was determined by Mr. Snelus in 1871 to have a calorific value of 14,718 units per 1 lb. Mr. Stead (see Table VII., page 727) has calculated the value of the coal used at Newcastle at 14,940 units per 1 lb., or about $1\frac{1}{2}$ per cent. higher, so that the coal consumption at Newcastle must be multiplied by 1·015 to make it comparable

with that of Cardiff. Table V., on page 726, gives the comparative results.

Taking the second line, the figures of which are strictly comparable, it will be seen that the prize simple-engine at Newcastle consumed 2·678 lbs. of coal per brake horse-power against 2·79 used by the prize engine at Cardiff, a gain of 4 per cent., while the prize compound-engine consumed only 1·902 lbs. of coal per brake horse-power, a gain of 32 per cent., or nearly one-third.

Whence comes the important improvement which these trials have so conclusively established? It is not easy to imagine that Messrs. Davey Paxman's simple engine was designed any better or was more accurately fitted than Messrs. Clayton and Shuttleworth's engine, which carried off the first prize at Cardiff; nor can it be supposed that the handling of the engine at Newcastle was better than that at the earlier trial. The cause, therefore, of the success achieved must be sought chiefly in the thermo-dynamic principles involved. The Royal Agricultural Society, in the supposed interests of public safety, had at Cardiff, and previously, restricted the steam pressure at which engines were allowed to work; but as design, materials, and workmanship improved, the restrictions were relaxed, and on the introduction of the compound system were practically removed altogether.

It is a fundamental principle of all heat engines that the quantity of work done depends on the amount of heat which is converted into work; steam, air, or gas of any kind, is merely the agent by which the conversion takes place, and can do no work without falling in temperature or yielding up heat. Hence it follows that the greater the fall of temperature during the working of a heat engine the greater the proportion of work got out of the agent. Supposing it were possible to get all the heat out of a perfect gas, a temperature would be reached which is known as "Absolute Zero," and is minus 460° on the Fahrenheit scale. "Absolute temperature" means the temperature measured from absolute zero; hence, to convert our ordinary temperatures into absolute, it is only necessary to add 460° to them. Now the doctrine of Carnot asserts that the proportion of work which it is possible to obtain from the heat depends upon the ratio which the fall of temperature in the working substance bears to the original absolute temperature; in other words it depends upon what proportion of all the heat from absolute zero can in practice be wrested from the working agent. Obviously there are two ways in which this proportion may be increased: the one, the not allowing the agent to escape till it has been cooled low down, so as to yield up more heat: the other, to start at a higher temperature. This is true as well of the generation of

the steam as of its employment when generated. As regards the generation of steam, the proportion will depend on the temperature of the fire and on that of the escaping products of combustion; while as regards the employment of the steam, the proportion will depend on the temperature of the steam as it enters the cylinder, and the temperature when it leaves it.

In non-condensing engines, such as those under consideration, the temperature of the exhaust steam cannot be below 212° (leaving out of the question the use of a portion of this steam for heating the feed-water—which matter, however, involves a change in the physical condition of the agent) and, therefore, the only way to improve the proportion is to start with a higher temperature of steam. But the pressure of steam cannot be increased without a corresponding increase of temperature, and the advantage derived from using higher pressure steam is a consequence of its higher temperature. In the annexed Table VI., p. 727, the Reading Iron Works' Engine, tested at Cardiff, and the two prize engines and Mr. Foden's compound engine, tested at Newcastle, are compared. The third line gives the absolute temperature of the steam in each case; the fourth line the fall of temperature, on the supposition that the steam leaves the cylinder at a temperature proper to 1 lb. back pressure, that is 215°; the fifth line is the quotient of the division of the fourth by the third, and shows the proportion of work to be expected. The sixth line is the reciprocal of the fifth reduced to one as the standard of the Reading Iron Works' engine, and represents the proportion in which the steam should have been consumed, that being, of course, inversely as the amount of duty to be expected.

We see that Messrs. Davey Paxman and Co.'s simple engine should have demanded about 7 per cent. less steam, and their compound $23\frac{1}{2}$ per cent. less than the Reading Iron Works' engine. In reality their simple engine, as will be seen by the eighth line, took 13 per cent. less, while the compound took nearly 30 per cent. less than the Reading Iron Works' engine.

Considered apart from their boilers, it will appear that Davey Paxman & Co.'s Simple Engine and their Compound Engine each in round numbers exceeded by some 6 per cent. the duty which, having regard to the increase of the pressure of steam above that of the Reading Iron Works' engine tried at Cardiff, and taken here as a standard, would have led one to expect, while Mr. Foden's engine used an amount of steam which was about 6 per cent. more than the foregoing calculation anticipated, so that his result fell a little below that of Davey Paxman's compound, working at 100 lbs. less pressure.

From the foregoing it is clear that it must not, however, be hastily assumed that an indefinite amount of economy is to be derived from the use of higher pressures. The increase in the temperature of steam does not correspond to the increase in pressure, but rises more slowly than the pressure increases; thus:—

From	boiling-point	to 50 lbs.	temperature	rises	55°
„	50 lbs.	100 „	„	„	38°
„	100 „	150 „	„	„	29°
„	150 „	200 „	„	„	20°
„	200 „	250 „	„	„	18°

and consequently the fall of temperature in working bears a smaller proportion to the fall of pressure, and all the mechanical difficulties connected with high-pressure steam have to be grappled with for, it may be, inadequate gain. These trials appear to point to the conclusion that, with our present state of knowledge, it is probable that pressures between 150 and 200 lbs. per square inch will give the best practical results.

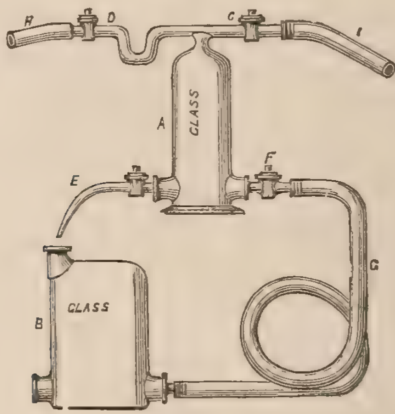
One of the heads of information needed in investigating the performance of engines under trial is the quantity of air passing through the boilers, and arrangements were made for measuring this directly by closing the ash-pans of the boilers, and arranging two rectangular orifices through which alone the air was suffered to enter the furnaces, and in passing through which its velocity could be measured by means of wind gauges. It was found, however, that combustion did not take place as efficiently when the current of air was restricted to two streams as when it was allowed to enter throughout the whole width of the ash-pan; but fortunately we were spared the necessity of making other arrangements by reason of the ease and rapidity with which Mr. Stead was enabled to calculate, from the analysis of the gases escaping from the boilers, the quantity of air. His results are the more valuable in that they represent what took place during a prolonged trial in the actual running conditions of the engines. It must, however, be borne in mind that this mode of computing the air measures not only that which passes through the fuel, but also that which enters by the fire-door when it is opened for stoking.

It had long been the desire of the Royal Agricultural Society to obtain analyses of the products of combustion, and at Cardiff an attempt was made to collect the gases. But the apparatus devised proved unsuitable, and the time required to perform the analyses, and the cost involved, prevented any practical results from being obtained. Fortunately for the Society, and for the scientific completeness of the Newcastle experiments, the assistance of Messrs. Pattinson and Stead was invoked, with the

result that complete analyses were made and the results were furnished even while the engines were running. It will thus be easy, in future trials, to arrange for collecting samples of the products of combustion continuously during a whole run, and to determine also the effects of different modes of firing, and the management of the ash-pan and chimney-dampers. Mr. J. Pattinson is the Public Analyst of Newcastle, and Mr. J. E. Stead occupies the same position at Middlesbrough. To the latter gentleman is due the invention of an apparatus, by means of which the analysis of the products of combustion is rendered easy and expeditious. The process consists of two parts—first, the collection of the products, and secondly their analysis.

The apparatus for collecting the gases consists (see Fig. 1) of a mercury vessel A, 7 in. high and $1\frac{3}{4}$ in. diameter, which is connected by the tube H

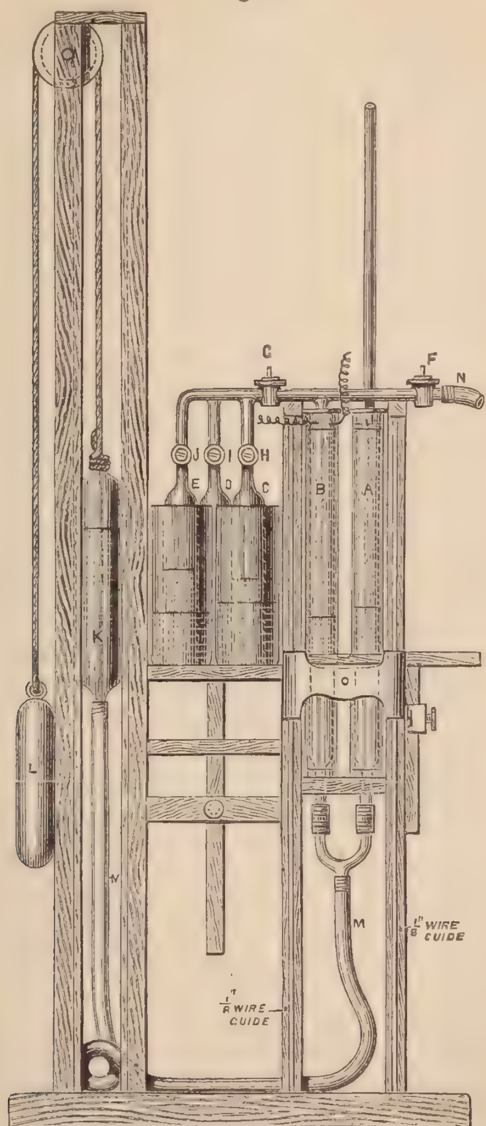
Fig. 1.



and cock D to the place from whence the sample is to be drawn; in the case of the engines at Newcastle, from a spot just above the tubes and below the blast nozzle. B is a receiver into which the mercury can flow from the vessel A through the pointed pipe and cock E. G is an india-rubber pipe connecting the bottoms of the two vessels, and capable of control by the cock F. The vessel A being full of mercury, and vessel B empty, the cocks E and F closed, the pipe H is connected to the desired point of the smoke-box, the cocks D and C are opened, and sufficient of the products are sucked through the tube I to ensure all the air being withdrawn. The cock C is then closed, the cock E opened, and the mercury is allowed to flow out at any desired speed. The products of combustion are thus drawn into the vessel A through the pipe H, and, depending on the rate at which the mercury is permitted to flow, the sample in A may be collected either in a few minutes or the collection may extend over as many hours as may be desired, and it is evident that an average sample will be obtained. To refill A with mercury, the cocks F and C must be opened and the vessel B must be raised to a higher level than A, when the mercury will flow back by the tube G, and all will be

ready for a fresh sample. This apparatus is fitted into a box arranged for safe and convenient transport.

Fig. 2.



The analysing apparatus consists of a wooden base-plate, Fig. 2, about 14 in. by 9 in., on which are arranged two high upright slides and two

specially-constructed stands. In this framework are supported a pair of tubes, A and B, connected at their lower ends by a breeches-piece to an india-rubber tube M, which unites them to a vessel of mercury K suspended by a cord passing over a pulley and balanced by the weight L. The tubes A and B are surrounded by water-jackets, for the purpose of maintaining a constant temperature throughout the analysis—a very important point, because it eliminates the tedious calculations necessitated by the changes of volume due to changes of temperature. The tubes and their jackets are of glass. The tube B is graduated, and a small spirit level O slides up and down on a pair of wires in front of the tubes, and enables the mercury to be set exactly level in the two tubes, and as tube A is open to the atmosphere, the pressure in B must be the same when the mercury columns are level. C is an inverted bell tube dipping into a beaker of caustic potash. E is an inverted bell tube containing hydrogen. D is a similar inverted bell tube which covers a pair of platinum poles, by means of which the water contained in the beaker can be decomposed by means of a current of electricity produced by a battery of six small cells, which also serve to send an electric spark by means of a Rhumkorf coil through the top of the tube B. Cocks F, G, H, I, J, govern the various tubes.

The mode of operating is as follows:—The mercury vessel K is hoisted till the tube B is full of mercury, the gas to be analysed is connected to the tube N—corresponding to tube I, Fig. 1; the cock F is opened, the cock G being shut, the vessel K is depressed, lowering the mercury in the tube B, until sufficient gas has been drawn in; the cock F is then closed, and the vessel K is manipulated till the mercury in tubes A and B stands at the same level; the volume in B is then read off. Cocks G and H are next opened, the mercury vessel K hoisted, and the gas is passed into the bell tube C, where the carbonic acid gas is absorbed by the caustic potash. After a minute or two the gas is drawn back into the tube B, where the volume is measured; the gas is then returned into C, and left another minute or two to make sure that all the carbonic acid has been absorbed. It is then returned to B, and the volume measured again, and if there be no change, the absorption has been perfect and the volume of carbonic acid has been measured. Next, cocks H and G are closed, some water is decomposed in D, and a small portion of the explosive mixture is allowed to flow into B, when it is exploded by means of the electric spark, and by that means any carbonic oxide present is burned at the expense of the free oxygen associated with the excess of air which is generally found in the products of combustion. The gases are again passed into C, and the carbonic acid generated by the explosion absorbed; the gas is then returned to B, the volume measured, and by that means the volume of carbonic oxide determined. Next a measured quantity of hydrogen from E is passed into B, and the mixture fired. By this means the remaining free oxygen is removed, the volume remaining measured, and the quantity of oxygen and nitrogen, and therefore of air, is determined. The hydrogen in the coal combining with the oxygen of the air does not appear in the products, but can be estimated from the volume of nitrogen.

The description given above may seem tedious, but the working of the apparatus is exceedingly simple, and we frequently witnessed the completion of an analysis in the engineer's office in about one-quarter of an hour—in fact, Mr. Stead was often able to announce the composition of the waste gases before the run during which the sample was taken was complete.

Table No. XII., page 732, furnished by Mr. Stead, gives the

results of his analyses of the waste gases. This table shows very clearly the amount of air allowed to pass through (or over) the fire, and the extent of the excess above that theoretically needed, which is one source of loss, the exact value of which we shall deal with hereafter, and shall contrast it with another loss which arises from a insufficiency of air at some period of the run.

We will now consider a source of loss which renders the protection of steam boilers and engines from escape of heat by radiation and by convection a matter of considerable importance.

Loss from Radiation and Convection.

As observations on this subject have not been attempted at previous "Trials," it may be well to describe the process by which the loss of heat per hour at the working pressure and temperature has been determined.

As soon as the engines had finished their trials they were left to cool, the ash-pans having been closed as far as practicable, so as to avoid draught through the boilers. At certain intervals the steam pressure, or the temperature of the water in the boilers, was noted, and from the records so obtained, the rate of cooling is arrived at in the following manner:

The weight of water in the boilers at the working level, and the volume of the steam space of each boiler, had been ascertained by weighing the engines when their boilers were quite full of water, when they were emptied partially, that is to the working level, and finally when they were quite empty; and the weight of such parts as were not sensibly heated when the engines were at work, as, for example, the wheels, axles, shafts, &c., was furnished by the makers. From these data it is easy to calculate the number of units of heat contained by a cooling engine with the pressures existing at the times when the observations were made. From the experiments of Regnault and of others, the number of units of heat contained in a pound of water or of steam under varying pressures and temperatures is known. The quantity of heat in water rises a little faster than the increase of temperature, and the quantity of heat in a pound of steam increases also with the temperature and pressure. (The precise amounts are to be found very conveniently arranged in the tables at the end of Mr. Cotterill's work on the steam engine.) The metals of which the boilers and machinery are composed were also heated, and parted with their heat on cooling. By far the greater proportion of the metal is iron or steel, and it may for our purpose all be assumed to be so, without sensible error. Now iron or steel requires only a little more than 11 per

cent. of the heat that water needs to raise it the same number of degrees in temperature, its "specific heat," as it is termed, being only ·1138. The quantity of heat contained by the iron is therefore found by multiplying its weight by ·1138, and by the number of degrees. The method of the whole calculation will probably be made clear if we go through a particular case, say Davey Paxman and Co.'s Simple Engine, No. 3125. Its trials were completed at 6.17 P.M., and at that time the pressure gauge marked 100 lbs., corresponding to 338·5° temperature. The steam space of this engine measured 18·23 cub. feet, the water at working level weighed 1317 lbs., the weight of metal affected by heat was 8052 lbs.

From Mr. Cotterill's tables it appears that a cubic foot of steam at 100 lbs. pressure, weighs ·2609 lbs., and that 1 lb. of steam contains 1185·1 units of heat above 32°, and 1 lb. of water at the temperature of the steam contains 310·23 units. Hence the total units of heat above 32° in the engine were:

				units.
Steam	..	c. ft. 18·23 × lbs. ·2609 × u. 1185·1	=	5,636
Water	..	1317 lbs. × 310·23u.	=	408,580
Metal	..	8052 lbs. × ·1138 × (338·5° − 32°)	=	280,850
		Total units of heat above 32°		695,066

As the engine cools, a portion of the steam is condensed, so that the weight of steam is constantly diminished, while the weight of water is increased, the sum of the two being constant at all times, and on this supposition Table VIII., page 728, has been calculated.

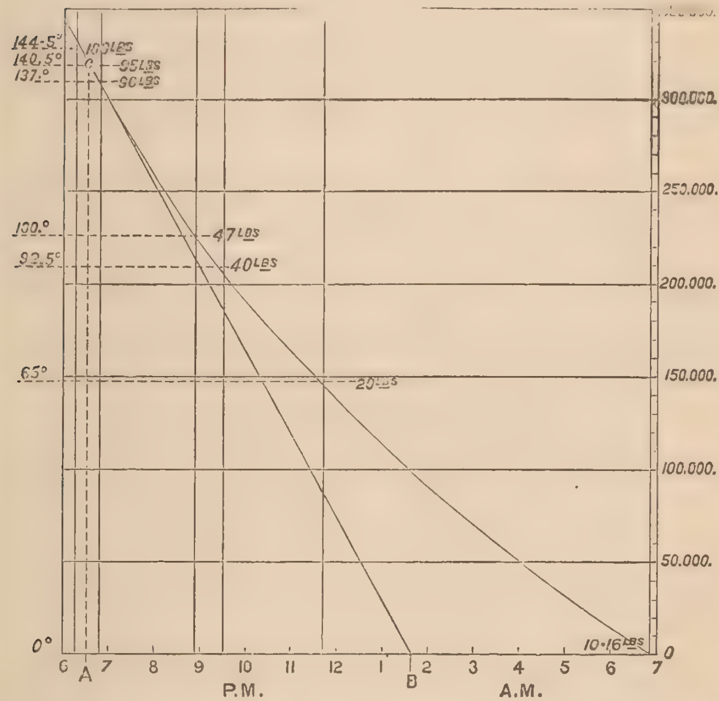
It will be noticed that no observation was made when the steam was at 95 lbs., its working pressure, yet it is at this point that we must know the rate of cooling.

To ascertain this, we construct the diagram (Fig. 3), on the base line of which we mark off the times at which the readings were taken, and on the ordinates or vertical lines, the units of heat which remained in the engines at each moment of observation; but to avoid an inconveniently large diagram, we make the zero-point at the last reading, or 6.50 A.M. on the day after the trial, by deducting the heat in the engine at that hour, namely, 364,600 units, from all the values above it.

Having determined these points, a line is run through them, and it will be seen that they fall in very closely to a uniform curve, which shows that the rate of cooling decreases with the decrease of pressure and temperature, a fact which is in accordance with the law that the rate of cooling is proportional to the difference of temperature between the hot body and the surrounding space. To show this more clearly, column 12 in Table VIII.,

page 728, gives the difference between the temperature of the air, which was about 70°, and the temperature of the engine at the times when the observations were made. Column 13 gives the difference between these temperatures and 124°, the lowest reading. If now we make the ordinate of the observation at 6 h. 17 min. equal to 144·5°, and set off upon it the other differences in column 12 to the same scale, and draw horizontal lines so as to cut the curve, it will be seen that the points of intersection coincide very nearly with the points indicating the

Fig. 3.



units of heat, thus showing that the loss of heat follows the same rate as the decrease in the difference of temperatures.

But there still remains the question, What is the rate of cooling at the working pressure 95 lbs.? The number of units of heat in the engine at 95 lbs. was 321,105 above the lowest observation. Plot this value on the ordinate of the 6 h. 17 min. observation, and draw a horizontal line till it cuts the curve at C, and draw the ordinate AC. This ordinate meets the base at 6 h. 30 min.: hence the steam fell to 95 lbs. at that time. Next from the

point C, draw a tangent to the curve cutting the base at the point B, which proves to be 7 h. 21 min. distance from A. It is clear that if the rate of cooling were uniform, as represented by the tangent C B, the 321,105 units of heat at C would be dissipated in 7 h. 21 min. (or 7·35 hours), instead of $12\frac{1}{4}$ hours, as was actually the case, but at C the tangent coincides with the curve, so at that point of it the rate of cooling was 43,688 units per hour.

In this manner the greater number of the engines were tried, and the results of the computations are given in Table IX., page 729.

To make the loss by cooling more evident, we have (in line 10) compared it with the number of heat-units latent in the coal consumed per hour, and the loss appears to range from $3\frac{1}{2}$ per cent. to $16\frac{1}{2}$ per cent. In line 11, the number of units dissipated per brake horse-power has been calculated and set down.

It will be noticed that Davey Paxman's Compound Engine, 3124, even after allowing for the increased temperature at which it worked, cooled about $27\frac{1}{2}$ per cent. more rapidly than their simple engine, 3125. The two engines were lagged in precisely the same manner. The compound had rather more surfaces in its machinery, but hardly enough to make the difference observed. Mr. Paxman suggests that the ash-pan damper of the compound engine might not have closed perfectly, and that thus a current of cold air was allowed to pass through the boiler.

It will be seen from the results obtained that much economy may be expected from careful and efficient lagging of all the hot parts of engines. This table also serves to explain, to some extent, why Mr. Foden did not do better with his higher pressures, and shows generally that, besides other reasons already given, the increased loss by cooling at higher pressures tends to set a limit to the economy to be derived from extending them beyond comparatively narrow limits.

The foregoing calculations, the observations made during the "Trials," and Mr. Stead's analyses, furnish the means of instituting a comparison between the quantity of heat generated by the combustion of the fuel and the amount utilized or dissipated wastefully; we can in fact compile a balance-sheet, on the debtor side of which will appear all the heat developed in the furnace, and on the creditor side an account of the various ways in which it was appropriated.

From the analysis of the wood used in rekindling the fires, after the preliminary runs, which will be found at the foot of page 707, and from that of the coal given in Table VII., page 727, it will be seen that carbon and hydrogen are the two elements,

by the union of which with the oxygen of the air the heat of combustion is evolved. In the case of the coal there is a little sulphur, but this adds only a quite insignificant amount of heat.

It is usual to speak of oxygen as a thing which in itself is non-combustible, but is the supporter needed for the combustion of other bodies. The fact is, that since the effects of combustion are produced, as has just been said, by the union of say carbon and oxygen, the oxygen is just as much a combustible as the carbon is, and the carbon is just as much a supporter of combustion when considered in relation to the oxygen as a combustible, as the oxygen is a supporter when considered in relation to the carbon treated as a combustible, and, when needed for simplicity, oxygen will be dealt with by us as forming part of the fuel. Now if in a fuel (using the word in the ordinary sense) there are found both oxygen and hydrogen, it has been demonstrated that these have already made their union, and that, therefore, no further chemical action will arise when the fuel is burnt, from the union of its hydrogen with the oxygen of the air, because union with oxygen has already taken place. Thus there must only be taken as available for the production of heat so much of the hydrogen as is in excess of that needed by the oxygen in the fuel to combine with it. Thus, in truth, all the hydrogen, which has with it its equivalent of oxygen, is inert, as is also its oxygen, and as indeed must be any oxygen in the fuel, whether accompanied by hydrogen or not, because that oxygen finds no hydrogen or other material in the air with which, in the burning of the fuel, it can associate. The researches of many eminent chemists have determined with great exactitude the quantity of heat developed by the combustion of many substances. Carbon, when completely burned in air, yields carbonic acid gas, and develops 14,544 units of heat per one pound of carbon. Hydrogen burned in the same way, produces water (giving forth 61,200 units of heat), or the vapour of water, and in the latter case develops 52,509 units of heat per one pound.

Wood similar to that used for rekindling the fire (which rekindling is referred to further on) was found, when dried at 380° Fahr., to have contained 22 per cent. of moisture.

The dried wood had the following composition :—

Carbon	49·95
Oxygen	41·27
Hydrogen .. .. :	6·00
Nitrogen	1·13
Ash	1·65
	100·00

The quantity of oxygen (41·27) stated above, would make an union with 5·16 of hydrogen. There was, as will be seen, a total 6·00 of hydrogen; deduct from this the 5·16 needed for the oxygen, and there remains 0·84 of hydrogen available for fuel; the rest of the hydrogen, with its oxygen, being in the form of water, or rather inchoate water, not capable of being expelled by drying.

The foregoing observations will be found applicable to the question of oxygen and hydrogen in the coal.

Having premised thus much, it will be well, by way of illustration, to calculate and draw up a Balance Sheet—say that of Davey, Paxman and Co.'s "Simple Engine," No. 3125.

With respect to the wood for rekindling, it should be stated that immediately after the preliminary run, the fire-grate and ash-pan were cleared and 14 lbs. of wood were placed on the firebars, the heat of which rekindled it at once: coal was then added, and the trial run commenced. This operation occupied three minutes.

The Debtor Side of the Account.

Debtor to the units of heat produceable by the fuel.

During the run, which lasted 263 minutes, 193 lbs. of coal were burnt. The temperature of the air was 70°, that of the products of combustion in the smoke-box 385°. Twenty-two per cent. of the wood, as already stated, were in the form of moisture, expellable by drying, equivalent on the 14 lbs. of wood to 3·08 lbs. The heat developed by the remaining 10·92 lbs. we calculate in the following manner.

		Units.
Carbon	10·92 lbs. × ·4995 × 14,544 u.	79,331
Hydrogen	10·92 lbs. × ·0084 × 52,509 u.	4,816
		84,147

The heat developed by the coal we estimate as follows:—

		Units.
Carbon	193 lbs. × ·884 × 14,544 u. ..	2,481,400
Hydrogen	193 lbs. × ·0333 × 52,509 u. ..	337,475
Sulphur	193 lbs. × 47	9,071
		2,827,946
Heat developed by the wood		84,147
Total from wood and coal		2,912,093

The Creditor Side of the Account.

The units of heat thus resulting from the combustion of the wood and of the coal we know to have been disposed of in the nine specified ways which follow, and even, after allowing for all of these, there is still some $3\frac{3}{4}$ per cent. for the dissipation of which we do not pretend to account with certainty.

No. 1.—By evaporating the water in the rekindling wood, and heating the steam of this water to the temperature of the smoke-box, at which temperature it escaped into the air. Now, as the wood was not dried before being used, there has to be considered, under this head, the 3·08 lbs. of absolute wetness which could be got rid of by drying; but in addition to this, we must take into account the inchoate water of which we have spoken, amounting to 10·92 lbs. × ·4643, namely, the oxygen with its corresponding hydrogen. This comes to 5·07, which added to the 3·08 of wetness, gives 8·15 lbs. of water to be vaporised and heated.

Let us see what demand this makes upon the heat units.

The 8·15 lbs. of water would have to be heated from 70° to 212°, would need to be evaporated at that temperature, and the steam formed would require to be heated from 212° to 385°. The rise of temperature of the steam from 212° to 385°, or 173°, must be multiplied by ·37, the specific heat of steam at constant volume, in order to get the number of units of heat expended in warming it. There was therefore required for this process

$$142^\circ + 996{\cdot}6^\circ + (173 \times {\cdot}37) = 1172{\cdot}6 \text{ units per 1 lb. of water.}$$

The heat expended in this work for the whole number of pounds was therefore

$$8{\cdot}15 \text{ lbs.} \times 1172{\cdot}6 \text{ u.} = 9557 \text{ units.}$$

No. 2.—The consumption of heat units by heating from 70° to 385° the wood and the air required for its combustion.

It appears, from experiments that have been made by others, that 1 lb. of wood similar to that which was used, but after drying, requires 6·084 lb. of air for its combustion. Of the dried wood we have shown that ·4643 was in the form of inchoate water. There remains therefore, in each lb. of dried wood only ·5357 to be associated with the air, making therefore, for each lb. of dried wood, 6·6197 lbs. of matter, which have to be raised 315°, *i.e.* from 70° to 385°.

A small portion of this matter, *i.e.* ·0756, being the union of

the free hydrogen with the oxygen of the atmosphere, will be in the form of steam, and will absorb

$$\cdot 0756 \text{ lbs.} \times \{(212^\circ - 70^\circ) \cdot 238 + (385^\circ - 212)^\circ \times \cdot 37\} \, 10 \cdot 92 \text{ lbs.} = 80 \text{ units,}$$

while the rest would assume the form of permanent gases at 385° temperature, and would therefore contain above the temperature of 70°

$$6 \cdot 5441 \text{ lbs.} \times 315^\circ \times \cdot 169 \text{ (the true specific heat of air)} \times 10 \cdot 92 = 3804 \text{ units,}$$

making in all 3884 units.

No. 3.—In evaporating the water in the coal, and heating the steam so produced to the temperature of the smoke-box.

The coal used contained 0·0083 parts of water as moisture, and 0·0287 parts of hydrogen and oxygen in the form of inchoate water, together ·037 parts of water, which, as in the case of the wood, would have to be heated to 212°, would have to be evaporated at that temperature, and the resulting steam of which would have to be raised to 385°. This for the 193 lbs. of coal consumed would absorb 193 lbs. × ·037 × 1172·6 u. = 8374 units, the ·037 water amounting to 7·141 lb. in the 193 lbs.

No. 4.—In heating the coal and the air necessary for its combustion from 70° to 385°.

The analysis shows that ·0333 parts of hydrogen were available for combustion and formed therefore ·2997 parts of water. The heat expended in heating this from 70° to the temperature of the smoke box would be

$$= \cdot 2997 \times \{(212^\circ - 70^\circ) \cdot 238 + (385^\circ - 212^\circ) \times \cdot 37\} 193 \text{ lbs.} = 5611 \text{ units.}$$

Deducting the moisture, the inchoate water, and the free hydrogen, together ·0703, there remain ·9297 parts, with which, to obtain perfect combustion, should be associated the 11·38 lbs. of air, less the oxygen already used for the combustion of the free hydrogen, making 12·04 lbs. per 1 lb. of coal, which have to be heated 315°, requiring

$$12 \cdot 04 \text{ lbs.} \times 315^\circ \times \cdot 169 \times 193 \text{ lbs.} = 123{,}710 \text{ units,}$$

making in all 129,321 units.

No. 5.—Displacement of the atmosphere by the products of combustion of the wood and coal.

As above stated, analysis shows that 11·38 lbs. of air were needed for the complete combustion of 1 lb. of coal and 6·08 lbs. for 1 lb. of dry wood. One pound of air at 32° or 492° absolute

measures 12·387 cubic feet; hence at 70° or 530° absolute the volume of the whole of the air would be

	Cubic ft.
$\dfrac{(193\text{ lbs.} \times 11\cdot38 + 10\cdot92\text{ lbs.} \times 6\cdot08)\ 12\cdot387\text{ cu. ft.} \times 530^\circ}{492^\circ} =$	30194
The coal and wood measured	2·56
Total volume at 70°	30196·56

Oxygen combining with carbon, forms carbonic acid without change of volume of the oxygen, but in combining with hydrogen its volume is doubled. Hence the volume of the products of combustion will be the volume of the air plus one volume of oxygen as regards that portion which was combined with the hydrogen. Now ·0333 parts of hydrogen combined with ·2664 parts of oxygen, the volume of which =

·2664 lb. × 11.204 c. ft. =	2·984 cubic feet
the air measured 11·38 lbs. × 12·387 =	140·97 „
so that the total products of combustion per 1 lb. of coal were	143·954 cubic feet,

and for the total quantity of coal at 32°

$$= 143\cdot95\text{ c. ft.} \times 193\text{ lb.} = 27{,}783\text{ c. ft.}$$

For the wood the hydrogen available corresponding to ·0672 parts of oxygen = ·0672 × 11·204 = ·753 c. ft. and 6·08 lbs. of air required for perfect combustion give 6·08 × 12·387 = 75·314 c. ft., making per pound of dry wood 76·067, and 76·067 × 10·92 = 830·65. Adding this to the volume of products of the coal, we get a total of 28,614 c. ft. at 32°, or 492° absolute, and consequently at 385°, or 845° absolute, the volume will be $= \dfrac{28{,}614 \times 845^\circ}{492^\circ} = 49{,}144$ c. ft.

In addition we have 8·15 lbs. of water in the wood and 7·141 lbs. in the coal, making together 15·291 lbs. of steam.

$$\frac{15\cdot291\text{ lbs.} \times 19\cdot913\text{ c. ft.} \times 845^\circ}{492} = 523\cdot5\text{ c. ft.}$$

	Cubic ft.
Which, added to the previously obtained 49,144, gives total volume of products at 385°	49,668
Less total volume of fuel (including air) at 70° ..	30,197
Total increase of volume	19,471

Now the work done is found by multiplying this increase of volume by the pressure of the atmosphere, which is 2117 lbs.

per square foot; and the corresponding heat-units are found by dividing by Joule's equivalent, 772; therefore

$$\text{the heat absorbed} = \frac{19{,}471 \text{ c. ft.} \times 2117 \text{ lbs.}}{772} = 53{,}394 \text{ units.}$$

No. 6.—Heat lost in heating excess of air admitted to the furnace, and in the displacing of the atmosphere thereby. Mr. Stead's analyses show that 23·45 lbs. of air per pound of coal were actually passed in, being an excess of 12·07 lbs. The air that passed in while the wood was burning was not measured, but as the grate was very bare most of the time, it is probable that at least three times the proper quantity found its way through the furnace; this would make 12 lbs. excess, so the total weight of excess air would be

$$10{\cdot}92 \text{ lbs.} \times 12 \text{ lbs.} + 193 \text{ lbs.} \times 12{\cdot}07 = 2460{\cdot}5 \text{ lbs.},$$

$$\text{volume at } 70^\circ = \frac{2460{\cdot}5 \text{ lbs.} \times 12{\cdot}387 \text{ c. ft.} \times 530^\circ}{492^\circ} = 32{,}833 \text{ c. ft.}$$

$$\text{volume at } 385^\circ = \frac{2460{\cdot}5 \text{ lbs.} \times 12{\cdot}387 \text{ c. ft.} \times 845}{492} = 52{,}346 \text{ c. ft}$$

the volume therefore had expanded by 19,513 c. ft., and the heat expended in pushing aside the air must have been

$$= \frac{19{,}513 \text{ c. ft.} \times 2117 \text{ lbs.}}{772} = 53{,}509 \text{ units.}$$

This air was also heated from 70° to 385° or 315°, therefore the heat expended in this manner would be

$$= 2460{\cdot}5 \text{ lbs.} \times 315^\circ \times {\cdot}169 = 130{,}980 \text{ units,}$$

making the total loss of heat by the excess of air admitted amount to 184,489 units. We have divided the heat expended in this case into two items, namely that converted into the work of pushing aside the atmosphere and that actually required to heat the air; but the total heat expended may be arrived at directly by multiplying the weight of air heated by the number of degrees to which the temperature had been raised, and by the so-called specific heat of air at constant pressure, which is ·238. According to this method the heat expended

$$= 2460{\cdot}5 \text{ lb.} \times 315^\circ \times {\cdot}238 = 184{,}460 \text{ units,}$$

which agrees very closely with the former calculations.

No. 7.—The most important work done by the heat generated in the furnace was the conversion of the water in the boiler into steam at 95 lbs. pressure above atmosphere. This we find

from Table III. page 724, was equivalent to the evaporation of 2162·5 lbs. of water from and at 212°, hence the heat absorbed

$$= 2162{\cdot}5 \text{ lbs.} \times 966{\cdot}6 \text{ units} = 2{,}090{,}300.$$

No. 8.—The heat lost by radiation and convection from the engine during the 263 minutes which the run lasted, to which must be added 3 minutes occupied in drawing the fire after the preliminary run, and relighting it, so that the total time of cooling must be taken as 266 minutes, or 4·433 hours.

From Table VIII. page 728, we find that the rate of cooling was 43,688 units per hour, hence the total loss was 43,688 u. × 4·433 h. = 193,670 units. The smoke-box of the boiler was unlagged, and during the run was very much hotter than while the engine was cooling, and would have a correspondingly increased influence on the temperature of the products of combustion, which were measured in the upper part of the smoke-box. Supposing the difference of temperature between the air and the surface of the iron to have averaged 315°, and taking the temperature of the air at 70°, the quantity of heat emitted by radiation and convection, calculated by the formula of Dulong and Petit, would amount to 1096 units per square foot per hour.

The area exposed was about 16 square feet, hence the total loss would be 16 squ. ft. × 1096 u. × 4·433 h. = 77,737 u., which, added to the quantity already ascertained, makes the loss come to 271,307 units.

No. 9. Lastly, the heat lost in ashes, and in the unconsumed fuel left on the grate at the end of the trial.

The weight of ash left by the wood and coal should, according to the analysis, have been :—

Firewood, 10·92 lb. × ·0165 = ...	·18 lb.
Coal, 193 lb. × ·0317 = ...	6·12 „
	6·30 „

The actual amount of ash weighed back was 10 lb., so that 3·7 of unconsumed matter at a red-heat remained. This was probably in the form of carbon, as the more volatile portions had most likely been driven off. Assume 500° as the average temperature of the ash, the heat remaining would be—

10 lbs. × 430° × ·238 = ...	102 units.
3·70 lbs. × 14,544 u. = ...	53,813 „
	53,915 „

Collecting all these figures, we arrange them in the form of the following balance-sheet :—

Balance Sheet of Messrs. Davey Paxman and Co.'s Simple Engine, No. 3125.

Dr.	Units.	Cr.	Units.	Percentage.
To the heat developed in furnace :—		By heat expended :—		
In the combustion of wood :—		1. In evaporating the water in the wood and heating its steam to 385°	9,557	·32
From Carbon	79,331	2. In heating the wood and the air required for its combustion from 70° to 385°	3,884	·13
„ Hydrogen	4,816	3. In evaporating the water in the coal and heating its steam to 385°	8,374	·29
In the combustion of coal :—		4. In heating the coal and the air required for its combustion from 70° to 385°	129,321	4·44
From Carbon	2,481,400	5. In displacing the atmosphere by the products of combustion of the wood and the coal with the air needed for their combustion	53,394	1·83
„ Hydrogen	337,475	6. In heating the excess of air	130,980	6·34
„ Sulphur	9,071	In displacing the atmosphere by the excess of air	53,509	
		7. In evaporating the water in the Boiler	2,090,300	71·78
		8. In radiation and convection	271,307	9·32
		9. In ashes and unconsumed fuel	53,915	1·85
		10. Unaccounted for	107,552	3·70
	2,912,093		2,912,093	100·00

The last column in the balance-sheet shows the percentage which each source of loss bears to the total amount of heat generated. Heating the fuel, using the word in its ordinary sense, and the air necessary for its combustion, and displacing the atmosphere (items 4 and 5) take $6\frac{1}{4}$ per cent.; while the cost of dealing with the excess air amounts to $6\frac{1}{3}$ per cent. The loss by cooling is, however, the most serious of all, and, although this engine was, as regards the usual parts, lagged with exceptional care, amounted to $9\frac{1}{3}$ per cent.

The losses which cannot be certainly accounted for amount to less than $3\frac{3}{4}$ per cent. A portion of these were probably due to the increased rate of cooling while the engine was at work, for the cylinders, piston rods, valve, spindles, and the working parts generally, were hotter, and therefore emitted more heat than when at rest.

The process by which this balance sheet has been obtained is sufficiently complicated. There is a simpler method of judging of the efficiency of an engine based upon the principle to which we have already alluded, namely, that the proportion of useful work to be got out of a heat-engine depends upon the proportion which the fall of temperature bears to the original absolute temperature. In the case of a boiler, the difference between the temperature of the furnace and that of the smoke-box represents the fall of temperature, while the initial absolute temperature is that of the furnace.

Unfortunately, we have, as yet, no trustworthy pyrometer for ascertaining the temperature of a furnace. Attempts were made to determine this by means of a Wilson's pyrometer. A ring of iron, of known weight, was buried in the glowing coal, and, when thoroughly heated, was quenched in a given weight of water; the rise in temperature of the water was oberved, and in this manner, if the specific heat of iron at various temperatures were accurately known, it would have been easy to calculate its temperature at the time of quenching. Could this heat have been ascertained, it is by no means clear it would have represented that of the fire, as this was so very thin that it was impossible to be sure that the iron ring was perfectly covered, and had really attained the temperature of the fuel, and, in addition, as we have just said, there is much uncertainty as to the specific heat of metals, and especially of iron at high temperatures. Under these circumstances, the attempt was abandoned. An approximation may however be arrived at in the following way. Setting aside the wood used for kindling the fire, the total weight of matter heated in the furnace per 1 lb. of coal was 24·45 lb. The specific heat of the coal, the air,

and the products of combustion may be taken, without much error, as that of air at constant pressure, namely ·238, so that per 1 lb. of coal, the contents of the furnace required 24·456 × ·238 = 5·819 units of heat to raise them one degree in temperature. According to Table VII. page 727, each pound of coal is capable by its combustion of yielding 14,940 units of heat when the watery vapour, amounting to ·2997 parts, which forms one of the products of combustion is condensed, and by that means renders the latent heat of that vapour sensible; but when the water formed escapes as vapour, its latent heat is not available, and must be deducted from the heat due to the energetic chemical action in the furnace. In addition there are the ·83 per cent. of moisture in the coal, and the 2·87 per cent. of hydrogen and oxygen in the proportion to form water amounting to ·037 parts in all, which are converted into steam at atmospheric pressure. Altogether ·3368 parts of steam are thus formed, and these render latent and absorb 325 units of heat, so that, making these corrections, the available heat of the fuel is reduced to 14,615 units per 1 lb. of coal.

Associated with the burning fuel were 23·45 lbs. of air, and supposing its average temperature to have been 70°, or 530° absolute, the heat contained in the air and coal, reckoning from absolute zero, would be 24·45 lbs. × 530° × ·238 = 3084 units, which added to 14,615 units due to combustion, makes the total heat of the products from absolute zero to be 17,699 units per 1 lb. of coal. We have seen that it required 5·819 units to raise the contents of the furnace one degree in temperature, hence 14615 units would be competent to raise the temperature of 1 lb. $\frac{14,615}{5\cdot819} = 2511°$, and as the absolute temperature of the air and coal was 530°, the absolute temperature of the furnace was probably not far from 3041°. The temperature of the escaping products of combustion was found to average 385°, or 845° absolute, so that the proportion of heat which it would be possible to utilize would be $\frac{3041° - 845°}{3041°} = \cdot722$. The consumption of coal was at the rate of 44·03 lbs. per hour, so that the available heat would be 44·03 lbs. × 17,699 u. × ·722 = 562,645 units.

This quantity of heat was appropriated in three ways:—

First, in evaporating 11·21 lbs. of water from and at 212° per 1 lb. of coal, and therefore per hour

44·03 lbs. × 11·21 lbs. × 966·6 u. = 477,110 units;

secondly, in supplying the loss due to radiation and convection,

which, according to Table IX., page 729, was at the rate of 43,688 units per hour, added to 17,536 units, the excess of cooling arising from the high temperature of the smoke-box; and thirdly, in ashes and unconsumed fuel amounting to 12,309 units, making altogether 550,643 units, leaving 12,002 units unaccounted for, a little more than 2 per cent. As we have carried the working no lower than 385°, we have nothing to do with what takes place below that temperature, and hence the simplicity of this mode of calculation.

The maximum temperature, and consequently the highest duty, will be attained when only the quantity of air theoretically necessary for combustion is used; every addition of air lowers the temperature, and carries off heat wastefully among the hot products of combustion escaping by the chimney. It is obvious from the foregoing that, with a given temperature for the escaping products of combustion, the useful effect will increase as the temperature of the furnace is heightened. The temperature of the chimney, 385°, in this case could hardly have been reduced much lower, for the steam temperature was 334, leaving a difference of 52° only. Mr. Foden used less air than any of the other exhibitors. This arose from the precaution he took of closing his chimney damper every time he opened his fire-door. In the peculiar way of managing the furnace always adopted at "Trials," namely of firing very often, laying on small quantities of coal at a time, the fire-doors are open a great deal, and much air enters in that way, never passing through the fuel at all. The effect of this can be easily seen on the thermometer in the smoke-box, for when the door or the ash-pan damper is opened, the mercury falls to a considerable extent at once. Had the other exhibitors been as cautious as Mr. Foden, still better results might have been attained.

Reverting to the Balance-Sheet and to its Credit side, it will be seen that items 1 to 5, involving, as a whole, an absorption of 7 per cent. of the heat produced by the fuel, are inevitable losses, so that indeed they might have been dealt with by deducting their amount from the fuel, before considering the heat that is available for work; but item 6, which relates to the excess of air, and comprises the two heads of heating that excess, and of displacing the atmosphere for its reception, gives a further amount of loss = 6·34 per cent., which is (at all events to some extent) preventable. In the case of this engine, No. 3125, we have an excess of air weighing 12·31 lbs. for each lb. of fuel burnt, being, therefore, practically equal to the air which is theoretically needed,—while in engine No. 3114 the excess was

only 1·67 lbs., and in engine No. 3113, 4·02 lbs. It is clear, therefore, that if 3125 had been worked with no greater excess than 3114, the 6·34 per cent. of loss of item 6 would have been reduced by 5·49 per cent., leaving only ·85 per cent.,—unless, indeed, there had been a set-off to be allowed for.

With respect to this question of set-off, it will be seen that in the waste gases of 3114 there was 1·14 per cent. of carbonic oxide, while in 3125 there was no carbonic oxide whatever. Had there been in 3125 the same proportion of carbonic oxide as in 3114, the loss under this head would have amounted to 126,100 units of heat, or about 4 per cent., so that the 6·34 loss existing in the Balance-Sheet from excess of air would,—had 3125 been worked like 3114,—have been reduced by 2 per cent. only, the saving from not having an excess of air being, to the extent of 4 per cent., neutralised by the set-off due to allowing a portion of the carbon to escape in the incompletely consumed form of carbonic oxide. But great economy in the use of the air may be obtained without any carbonic oxide at all. For example, 3113, already quoted, while having an excess of only 4·02 lbs. of air (less than one-third of 3125), has no carbonic oxide whatever.

The true way of obtaining a perfect adjustment of the air to the fuel to be burnt, so as to prevent excess on the one hand and carbonic oxide on the other, is to apply some mechanical means of firing, such as can be adapted so readily when liquid fuel is used, or when coal is reduced, as has been done by Mr. Crampton, to the state of powder.

No doubt means exist, or may be devised, for feeding fuel in its ordinary form, so as to maintain a thoroughly regular fire—the essential condition for excellence of working.

Referring again to the Balance-Sheet, we find that No. 8 shows that in radiation and convection 9·32 per cent. of the fuel was dissipated, and dissipated in a way that means inconvenience to those who are in the neighbourhood of the engine.

It is not for us to suggest any particular kind of boiler-clothing composition, but we do call attention to the absolute need of efficient clothing on all parts of the engine and boiler, even of the front of the fire-box, so commonly left naked, although no doubt great care must be taken that the clothing at this part is not of such a nature as to become ignited.

The loss under head 9, so far as regards that portion of it which was due to Unconsumed Fuel, arose simply from the stoppage of the trial at the end of a few hours, and would have formed a totally insignificant quantity in one extended to 24

hours, while that due to the Ash might with propriety, like the other items we have mentioned, have been deducted before setting up the Debtor side of the account.

The other preventable losses may be some of those in the Unaccounted-for item, No. 10, but as we cannot point out what they are, we are not ashamed to confess we cannot suggest a remedy.

There is one further point upon which we might touch, and that is, the desirability—with the object of saving the water-supply—of condensing the exhaust-steam. This, as is well known, is efficiently done in steam tram-car engines by air-condensers. It was done by Craddock nearly forty years ago, by a revolving air-condenser, and so efficiently as to produce a very appreciable vacuum, and it has been suggested to be done by the passage over the condenser of a stream of air to be directed on to the fire, so as not only to restore the water, but so as to get rid of some of the 4·44 per cent. of loss arising under head No. 4 of our Balance-Sheet (the heating of the air).

Newcastle Engine Trials—Tables.

In the Tables on the following pages the Catalogue numbers of the engines tried have been used for the sake of brevity and convenience. It may be useful, however, here to print the full names and addresses of the Exhibitors, with the price and description of each engine as given by the Exhibitor.

Portable Agricultural Engine, Self-moving or otherwise, on the Simple Principle, not exceeding Eight Horse-power.

3111.—Alnwick Foundry Co., Alnwick, Northumberland.—Eight horse-power portable engine. Specially designed for simplicity of working parts; also for improved method of attaching cylinder, saddle carriages, &c., to boiler, so as to avoid any inaccessible bolts through the boiler shell. Price £180.

3114.—Foden, E. & Sons, Sandbach, Cheshire.—Traction engine, single high pressure, 8 horse-power. This engine is fitted with Foden's patent adjustable spring arrangement. Steel boiler, steel gear, shafts and motion throughout. Two speeds, compensating gear, winding drum, and water lifter. Maximum pressure 180 lbs. per square inch. Price £400.

147.—Jeffery & Blackstone, Rutland Iron Works, Stamford.—The "Viator" vertical engine and boiler combined, on two 5 feet wrought-iron travelling wheels. A new style of portable vertical engine well adapted to take the place of the ordinary small-sized portables now generally in use, being less expensive, easier of draught, and taking up less room when travelling as well as when in use. When at work the boiler is upright, with its weight on the engine side of the axles, and consequently stands firm; but when travelling, the boiler is tipped forward, throwing the weight over the axles, and thus putting a slight weight on the horse's back. Maximum pressure 60 lbs. to the square inch. Price £100.

3108.—McLaren, J. & H., Midland Engine Works, Leeds.—Portable engine, 8 horse-power, single cylinder. Automatic expansion valves, controlled by governors, wrought-iron road wheels and under gear. Maximum pressure 125 lbs. per square inch. Price £175.

3125.—Davey Paxman & Co., Standard Iron Works, Colchester.—Single cylinder portable steam engine, 8 horse-power, with boiler constructed for a working pressure of 100 lbs. per square inch. The engine is provided with Paxman's patent automatic expansion gear and adjustable high-speed governors, and complete with all the latest improvements. Price £202.

3117.—Humphries, Edward, Atlas Iron Works, Pershore.—Eight horse-power single cylinder portable steam engine, with improved governors and valve gear. Maximum working pressure 100 lbs. per square inch. Price £190.

Portable Agricultural Engine, Self-moving or otherwise, on the Compound Principle, not exceeding Eight Horse-power.

3115.—Cooper, Thomas, Ryburgh, Norfolk.—A compound self-moving engine. Is of ample power to drive the largest size threshing machine and elevators, and to move same from place to place. Is fitted with Exhibitor's patent driving gear and reversing motion; has water-lifter and heater, and with 16-inch road wheels is only 6 feet wide over all. Price £325.

3113.—Foden, E. & Sons, Sandbach, Cheshire.—Compound traction engine, 8 horse-power. This engine is fitted with Foden's patent adjustable spring arrangement; also with Foden's new patent compound starting gear, by which the compound action may be instantly suspended when required for starting heavy loads, &c., and is so arranged that each cylinder gives off equal power, and both exhaust independently of each other in funnel. Maximum pressure 350 lbs. per square inch. Price £460.

3124.—Davey Paxman & Co., Standard Iron Works, Colchester.—Compound portable engine, 8 horse-power, with steel boiler constructed for a working pressure of 140 lbs. per square inch. The engine is provided with Paxman's patent automatic expansion gear, and adjustable high-speed governors, and complete with all the latest improvements. Price £290.

3107.—McLaren, J. & H., Midland Engine Works, Leeds.—A compound portable agricultural engine, 8 horse-power, with high and low pressure cylinders. Automatic expansion controlled by the governors, wrought-iron road wheels and under gear. Maximum steam pressure 175 lbs. per square inch. Price £200.

3116.—Humphries, Edward, Atlas Iron Works, Pershore.—Eight horse-power, two cylinder compound portable steam engine, with improved governors and valve gear. Maximum working pressure 100 lbs. per square inch. Price £315.

TABLE I.—DIMENSIONS OF ENGINES.

	SIMPLE ENGINES.						COMPOUND ENGINES.				
Catalogue number (see page 720)	3111.	3114.	147.	3108.	3125.	3117.	3115.	3113.	3124.	3107.	3116.
Diameter and stroke of high-pressure cylinder in inches ..	$8\frac{3}{4}\times 12$	$7\frac{1}{2}\times 10$	$5\frac{3}{4}\times 9$	$8\frac{1}{2}\times 15$	$9\frac{1}{2}\times 12$	$10\frac{1}{4}\times 14$	6×11	$4\frac{3}{4}\times 10$	$5\frac{3}{4}\times 14$	$5\frac{3}{4}\times 15$	$7\frac{1}{2}\times 14$
Diameter and stroke of low-pressure cylinder in inches ..	..	..	..	..	..	..	9×11	$9\frac{1}{2}\times 10$	$9\frac{1}{4}\times 14$	9×15	12×14
Mean clearances and ports, high-pressure cylinder, in cubic inches	100·7	..	23·0	99·5	90	..	75·0	..	54·0	62·2	
Mean clearances and ports, low-pressure cylinder, in cubic inches	..	..	..	..	..	..	108·3	..	128·5	103·0	
Intermediate space, cubic inches	..	..	..	..	..	..	875	..	517	427·4	
Diameter and width of fly-wheel	$48\frac{3}{4}\times 6\frac{1}{8}$	53×6	40×5	$60\times 7\frac{1}{8}$	60×7	$60\times 7\frac{1}{2}$	$48\times 6\frac{1}{2}$	53×6	60×6	$60\times 7\frac{1}{8}$	$60\times 7\frac{1}{2}$

For other particulars of the engines, refer to reports of the various engines on pages 677 to 689.

TABLE II.—PRINCIPAL DIMENSIONS OF BOILERS.

	SIMPLE ENGINES.						COMPOUND ENGINES.				
Catalogue Number (see page 720)	3111.	3114.	147.	3108.	3125.	3117.	3115.	3113.	3124.	3107.	3116.
General description of Boiler	Loco.	Loco.	Vertical	Loco.	Loco.	Loco.	Loco.	Loco.	Loco.	Loco.	Loco.
FIREBOX AND GRATE.											
Area of ordinary grate in sq. feet	6·68	3·35	2·6	6·7	5·73	5·93	3·67	3·35	5·33	6·7	5·93
Area of grate as used at trial in sq. feet ..	5·98	2·63	2·6	3·39	4·69	4·18	3·67	2·63	4·32	3·39	4·18
Width of bar in inches	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$
Width of air spaces in inches	$\frac{5}{8}$	$\frac{1}{4}$	$\frac{7}{16}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{8}$
Area of air spaces in sq. feet	2·2	·96	·51	1·98	1·30	2·17	·75	·96	1·24	1·98	2·17
Area of air spaces as used at trial in sq. feet	1·7	·77	·51	1·11	1·16	1·53	·75	·77	1·1	1·11	1·53
Height of firebox crown above bars in inches	$36\frac{1}{2}$	$30\frac{3}{4}$	$24\frac{1}{4}$	$30\frac{1}{4}$	$32\frac{1}{2}$	29	$31\frac{1}{2}$	$25\frac{1}{4}$	31	$30\frac{1}{4}$	29
HEATING SURFACE.											
Length from out to out of tube plates in inches	75	72	35	$81\frac{3}{4}$	$84\frac{3}{4}$	$79\frac{3}{4}$	$82\frac{1}{2}$	66	$84\frac{3}{4}$	$81\frac{3}{4}$	$79\frac{3}{4}$
Number of tubes	24	76	27	51	53	30	22	76	53	51	30
Material of tubes	Iron	Steel	Iron	Iron	Steel	Iron	Iron	Steel	Steel	Iron	Iron
Outside diameter of tubes in inches	$2\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{3}{4}$	2	2	$2\frac{5}{8}$	$2\frac{1}{2}$	$1\frac{5}{8}$	2	2	$2\frac{5}{8}$
Inside diameter of tubes in inches	$2\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{13}{16}$	$2\frac{1}{2}$	$2\frac{5}{16}$	$1\frac{1}{2}$	$1\frac{13}{16}$	$1\frac{1}{2}$	$2\frac{1}{2}$

Heating surface of firebox in sq. feet	37·2	20·45	13·8	34·5	*40·8	28·3	23·0	17·0	28·1	34·5	28·3
Heating surface of tubes in sq. feet	106·9	188·5	35·2	180·1	194·2	135·6	98·3	172·6	194·2	180·1	135·6
Heating surface of smokebox in sq. feet ..	4·59	2·6	..	3·5	3·1	3·8	3·6	2·6	4·4	3·5	3·8
Total water-heating surface in sq. feet ..	148·7	211·5	49·0	218·1	238·1	167·7	124·9	192·2	226·7	218·1	167·7
Sq. feet of water-heating surface to nominal HP. of Engine	18·6	26·4	16·3	27·2	29·6	20·9	15·6	24·0	28·3	27·2	20·9
Ratio of area through tubes to normal grate area	·122	·274	·127	·092	·164	·171	·171	·274	·176	·092	·171
Area of chimney in sq. feet	·505	·49	·248	·57	·49	·6	·44	·586	·49	·57	·6
Area of blast nozzle in sq. inches	2·4	3·7	·785	3·14	1·76	4·9	2·07	3·14	1·76	3·14	4·9
Ration of heating surface to normal grate area	22·2	63·1	18·8	32·5	41·5	28·1	34·0	57·3	42·5	32·5	28·1
Weight of water in boiler when quite full in lbs.*	2436	1932	728	2352	2451	2573	2212	1687	2598	2415	2492
Weight of water at normal level in lbs.	1680	1134	329	1428	1317	1477	1346	987	1393	1428	1344
Steam space in cubic feet	12·05	12·83	6·41	14·85	18·23	17·62	12·49	11·3	19·37	15·86	18·45
Height of bottom of gauge glass above firebox in inches	Level	1½	8½	2¼	3⅝	1⅜	2⅛	1½	3⅜	2¼	1⅜
Arrangement of ashpan damper	Hinged ashpan door.	No damper to ashpan, throttle-valve in chimney.	Hinged ashpan-door.	Hinged ashpan-door.	Hinged ashpan-door.	Hinged ashpan-door.	Hinged ashpan-door.	No damper to ashpan, throttle-valve in chimney.	Hinged ashpan-door.	Hinged ashpan-door.	Hinged ashpan-door.

* This includes 8·37 square feet of heating surface, due to the eight Paxman water tubes in the firebox.

Table III.—Results of Experiments connected with the Boilers.

(Theoretical evaporative power of the coal from and at 212° = 15·45 lbs. Air theoretically required per 1 lb. of coal 11·38 lbs.)

	Simple Engines.						Compound Engines.			
Catalogue Number (see page 720)	3111.	3114.	147.	3108.	3125.	3117.	3115.	3113.	3124.	3107.
1. Water supplied to engines .. .. lbs.	3182	1413	667·5	1868	1674	2894	2414	1394	1658	1967
2. Temperature of water supplied .. F°.	62	63	62	63	63	62	63	65	64	63
3. Average temperature to which the feed-water was raised by condensed steam .. F°.	..	83·6	..	91·6	123·6	104·5	154·3	82·5	118·2	91·4
4. Calculated weight of steam condensed in heating feed-water .. .. .. lbs.	..	26·6	..	49·12	96·1	114·5	215·	22·2	84·7	51·4
5. Calculated weight of steam condensed in jackets from and at 212° .. .. lbs.	..	161·7	..	272·5	230·5	214·8	..	215·	269·8	280·4
6. Coal consumed .. .. .. lbs.	404·	138·25	113·	199·75	193·	351·	259	148·5	168·	202·5
7. Water evaporated from and at 212° exclusive of jacket-water .. .. .. lbs.	3676	1630·8	771·09	2156	1932	3313	2786	1606	1912	2270
8. Water as above evaporated per 1 lb. of coal	9·1	11·79	6·82	10·79	10·01	9·52	10·75	10·81	11·38	11·21
9. Estimated weight of water evaporated including that from jackets from and at 212° lbs.	..	1792·5	..	2428	2162·5	3557·8	..	1821	2181·7	2550·4
10. Water as above evaporated per 1 lb. coal from and at 212° .. .. .. lbs.	..	12·96	..	12·27	11·21	10·14	..	12·26	12·99	12·59
11. Efficiency of boiler and of its management, taking the theoretical value of the coal at 15·45	·589	·839	·412	·786	·725	·656	·696	·794	·840	·814
12. Weight of air passed through per 1 lb. of coal burnt .. .. lbs.	23·17	12·42	16·91	26·20	23·45	17·435	19·03	15·22	24·43	27·43
13. Percentage of air in relation to theoretical quantity 11·38 lbs. per 1 lb. .. %	203·6	109·1	148·6	230·3	206·1	153·2	167·2	132·7	214·7	241·0

—Results of Experiments Relating ...

Catalogue Number (see page 720) ..	Simple Engines. 3111.	3114.	147.	3108.	3125.	3117.	Compound Engines. 3115.	3113.	3124.	3107.	3116.
1. Number of brake used	3	2	1	3	1	3	3	2	1	3	3
2. Time running . .. .. minutes	245	263·5	251	263	263	241	245	261	268	264	146
3. Number of revolutions .. .. total	37,342	45,409	39,178	35,482	35,559	35,154	42,438	41,730	37,496	39,340	26,549
4. Revolutions per minute	152·4	172·3	156·1	136·3	135·2	145·9	172·9	159·9	139·9	149·0	181·8
5. Declared number of revolutions per minute	150	168	160	130	132	130	170	156	134	135	185
6. Total weight hanging on brakes lbs.	187·75	120·75	43·5	233·75	236·5	219·75	186·75	202·75	274·5	265·75	190·75
7. Circumference of brake load circle feet	17·32	17·565	17·28	17·31	17·225	17·3	17·31	17·575	17·24	17·31	17·31
8. Coal consumed during runs .. lbs.	404	138·25	113	199·75	193	351	259	148·5	168	202·5	249
9. Coal consumed per hour .. .. lbs.	98·93	31·48	27·01	45·57	44·03	87·386	63·43	34·14	37·61	46·02	102·3
10. Indicated horse-power	..	13·88	*3·508	23·43	19·82	20·15	21·12	18·63	22·77	24·02	22·1
11. Declared horse-power	16	12	4·5	17	17	16	18	18	20	20	20
12. Brake horse-power, excluding correction for friction of brakes	15·02	11·08	3·555	16·71	16·69	16·80	16·93	17·27	20·06	20·77	18·19
13. Brake horse-power, with friction of brakes added	15·31	11·37	3·798	16·976	16·94	17·08	17·25	17·57	20·33	21·07	18·52
14. Coal consumed per hour per brake horse-power, excluding friction of brakes .. .. lbs.	6·588	2·842	7·6	2·727	2·638	5·20	3·746	1·977	1·874	2·267	5·624
15. Coal consumed per hour per brake horse-power, with friction of brakes added .. .. lbs.	6·466	2·766	7·111	2·684	2·599	5·114	3·675	1·943	1·850	2·184	5·535
16. Horse-power as calculated at the time of the trials	16·19	12·27	4·329	17·83	17·46	17·99	15·30	18·48	20·89	22·02	19·54
17. Coal consumed per brake horse-power, as calculated at trials, and published in the papers .. .. lbs.	6·11	2·566	6·239	2·555	2·52	4·850	3·47	1·847	1·80	2·09	5·24
18. Ratio of indicated horse-power to brake horse-power, with friction allowance, as line 13	..	·819	*1·082	·724	·855	·818	·818	·943	·893	·877	·837

* The indicator pipes supplied to this engine by the maker were very small.

TABLE V.—COMPARISON OF COAL CONSUMPTION between the CARDIFF and NEWCASTLE TRIALS.

CARDIFF TRIALS.

	SIMPLE ENGINES.						COMPOUND ENGINES.		
	Newcastle Trials.			Cardiff Trials.			Newcastle Trials.		
	Davey Paxman.	J. & H. McLaren.	Edward Foden.	Clayton and Shuttleworth. Second trial.	Reading Ironworks.	Clayton and Shuttleworth. First trial.	Davey Paxman.	Edward Foden.	J. & H. McLaren.
Catalogue Number (see page 720)	3125.	3108.	3114.	4942.	2927.	4942.	3124.	3113.	3107.
	Powell's Duffryn Coal.			Llangennech Coal.			Powell's Duffryn Coal.		
Coal consumed per brake horse-power per hour, without allowance for friction of brakes	2·638	2·727	2·842	2·79	2·881	2·884	1·874	1·977	2·267
	Powell's Duffryn reduced to Llangennech.						Powell's Duffryn reduced to Llangennech.		
Consumption of coal as above, corrected for superior quality of Powell's Duffryn used at Newcastle	2·678	2·768	2·884	2·79	2·881	2·884	1·902	2·007	2·301
	Powell's Duffryn Coal.						Powell's Duffryn Coal.		
Coal consumed per brake horse-power per hour, with allowance for friction of brakes ..	2·599	2·684	2·766	..	..	..	1·850	1·943	2·184

TABLE VI.—COMPARISON between the THEORETICAL and ACTUAL ECONOMY derived from an INCREASE of STEAM PRESSURE.

	Cardiff.	Newcastle-on-Tyne.		
	Reading Ironworks. Simple.	Davey Paxman & Co. Simple.	Davey Paxman & Co. Compound.	Edward Foden. Compound.
Catalogue Numbers (see page 720)	**2927**	**3125**	**3124**	**3113**
1. Steam pressures above atmosphere .. .. lbs.	80	95	150	250
2. Temperature of steam .. .. F.°	324	334	365	406
3. Corresponding absolute temperatures .. .. F.°	784	794	825	866
4. Falls of temperature to 215° or 675° absolute .. .. .. F.°	109	119	150	191
5. Proportions which the falls bear to the original absolute temperatures	·139	·150	·182	·220
6. The reciprocals of the above ratios, to which reciprocals the fuel actually consumed should correspond, reduced to the Reading engine as unity	1·	·927	·763	·632
7. Water actually consumed per brake horse-power per hour (not including jacket-water) lbs.	30·22	26·40	21·33	21·38
8. Relative proportion of water used	1·	·873	·706	·707

TABLE VII.—ANALYSIS by MESSRS. PATTINSON and STEAD, Middlesbrough, of POWELL-DUFFRYN'S COAL used at the NEWCASTLE TRIALS.

Samples were collected at intervals during the trials, and the coal analysed was an average of these:—

Carbon	88·40	.. available
Hydrogen	3·65 — 0·32	$= 3\cdot33$ H
Oxygen	2·55 = 0·32 H	$= 2\cdot87$ H_2O (water)
Nitrogen	0·64	
Sulphur	0·76 = 1·36% pyrites	
Ash	3·17	
Water	0·83	
	100·00	
Sulphur in ash ..	0·04	

CALORIFIC VALUE in BRITISH THERMAL UNITS.

Carbon	·884 × 14,544 units =	12,856 units
Hydrogen ..	·0333 × 61,200 „ =	2,037 „
Pyrites estimated at		47 „
Total per one pound of coal		14,940 „

Weight of air required to burn one pound of coal, 11·38 lbs.

TABLE VIII.—COOLING OF DAVEY-PAXMAN'S SIMPLE ENGINE (No. 3125).

1. Time of Observation.	2. Steam Pressure in Boiler above atmosphere.	3. Temperature of Steam in Boiler.	4. Temperature of Steam above Freezing-point.	5. Weight of *18·23 cub. feet of Steam.	6. Units of heat above the Freezing-point in 18·23 cub. feet of Steam.	7. Weight of Water in Boiler.	8. Units of heat above Freezing-point in water.	9. Units of heat above Freezing-point in 8·52 lbs. of metal.	10. Total Units of heat above Freezing-point in Engine.	11. Total Units of heat in the Engine above those in the last Observation in Column 10.	12. Difference between the atmospheric temperature of 70° and the temperature of the Engine.	13. Degrees above the last reading in Column 12.
hr. min.	lbs.	Fahr. °.	Fahr. °.	lbs.	units.	lbs.	units.	units	units.	units.	Fahr. °	Fahr. °
6 17 P.M.	100·	338·5	306·5	4·756	5,636	1317·	408,580	280,850	695,066	330,466	268·5	144·5
Interpolated	95·	334·5	302·5	4·574	5,415	1317·18	403,100	277,190	685,705	321,105	264·5	140·5
hr. min.												
6 47	90·	331·	299·	4·366	5,765	1317·39	398,490	273,980	678,235	313,635	261·	137·
8 55	47·	294·	262·	2·725	3,191	1319·03	348,800	240,070	592,061	227,461	224.	100·
9 30	40·	286·5	254·5	2·375	2,777	1319·38	338,780	233,250	574,807	210,207	216·5	92·5
11 40	20·	259·	227·	1·549	1,798	1320·21	301,900	208,000	511,698	147,098	189·0	65·
6 50 A.M.	10·16	194·	162·	1·139	1,300	1320·62	214,860	148,440	364,600	..	124.	..

* This number, 18·23 cub. feet of steam, must have been diminished by the increased bulk of the water in the boiler as the steam condensed, amounting at the last observation to ·059 cub. feet, and also by the contraction of the boiler as the temperature decreased, but the difference is too trivial to justify attention.

Table IX.—Rate of Cooling of Engines and Boilers.

Catalogue Number (see p. 720)	Simple Engines. 3114.	147.	3125.	3117.	Compound Engines. 3115.	3113.	3124.	3107.
1. Weight of water in boilers at normal level .. .. lbs.	1,134	329	1,317	1,477	1,346	987	1,393	1,428
2. Volume of steam space cub. feet.	12·83	6·41	18·23	17·62	12·49	11·30	19·37	15·86
3. Estimated weight of engines and boilers affected by heat .. .. lbs.	17,752	2,147	8,052	7,756	7,097	19,488	8,314	8,648
4. Steam-pressure above atmosphere during trials .. lbs.	120	60	95	85	125	250	150	155
5. Temperature due to steam-pressure .. .. .. F.°	350	307	334	327	353	406	366	368
6. Brake horse-power, including friction of brakes .. h.p.	11·37	3·798	16·94	17·08	17·25	17·57	20·33	21·07
7. Coal consumed per hour lbs.	31·48	27·01	44·03	87·389	63·43	34·19	37·61	46·02
8. Units of heat evolved from coal per hour (14,940 units per 1 lb.)	470,310	403,530	657,820	1,305,600	947,610	510,800	562,050	687,550
9. Rate of cooling at the working-pressure in units per hour	70,813	41,060	43,688	46,105	51,159	84,143	62,477	46,510
10. Ratio of heat dissipated by cooling to heat evolved by coal	·151	·102	·066	·035	·054	·165	·111	·068
11. Units of heat dissipated by cooling per brake horse-power per hour	6,228	10,811	2,579	2,699	2,966	4,789	3,073	2,208

TABLE X.—INDICATOR DIAGRAMS. SIMPLE ENGINES.

1.	2.	3.	4.	5.	6.	7.
Catalogue Number. (See page 720.)	Steam-pressure in Boiler.	Mean Speed in Revolutions per Minute during Trial.	Indicated Mean Steam-pressure in Cylinder available for Power.	Indicated Cut-off.	Mean Indicated Horse-power during Trial.	Ratio of Brake Horse-power (Line 13, Table IV.) to Indicated Horse-power.
3111	lbs. 80	152·4	..	..	..	..
3114	120	172·3	37·0	·084	13·88	·819
147	60	156·1	19·8	Cut-off not defined owing to wire-drawing of steam.	3·508*	1·082*
3108	125	136·3	40·65	·128	23·43	·724
3125	95	135·2	32·23	·111	19·82	·855
3117	85	145·9	24·1	Cut-off not defined owing to wire-drawing of steam.	20·15	·848

* Error in observations, due probably to defective indicator-pipes.

TABLE XI.—INDICATOR DIAGRAMS. COMPOUND ENGINES.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
			High-pressure Cylinder.			Low-pressure Cylinder.			
Catalogue Number. (See page 720.)	Steam-pressure in Boiler.	Mean Speed during Trial.	Indicated Mean Steam-pressure available for Power.	Indicated Cut-off.	Mean Indicated Horse-power.	Indicated Mean Steam-pressure available for Power.	Mean Indicated Horse-power.	Total Indicated Horse-power of both Cylinders.	Ratio of Brake Horse-power (Line 13, Table IV.) to Indicated Horse-power.
	lbs.								
3115	125	172·9	34·5	·431	9·06	20·05	12·05	21·12	·818
3113	250	159·9	83·0	·065	11·36	12·8	7·27	18·638	·943
3124	150	139·9	47·5	·267	11·76	16·9	11·01	22·77	·893
3107	155	149·0	47·8	·161	13·51	14·8	10·504	21·02	·877
3116	100	181·8	32·7	·297	18·23	2·7	3·87	22·107	·837

TABLE XII.—ANALYSIS of the WASTE

Catalogue Number (see page 720)	Simple Engines.			
	3111.	3114.	147.	3108.
1. Total coal charged in lbs.	404·	138·25	113·	199·7
2. Ashes weighed back in lbs. ..	45·	7·50	21·	6·
3. Carbon in ashes in lbs.	32·2	3·12	17·42	..
4. Coal minus ashes actually consumed per lb. coal	0·88	0·95	0·81	0·9
5. Percentage by volume of the dry gas. Nitrogen	80·15	80·13	80·80	80·9
6. Carbonic oxide	0·50	1·25	..	..
7. Carbonic acid ..	7·75	15·75	10·25	7·7
8. Oxygen	11·60	2·87	8·95	11·3
9. Air	55·24	53·67	42·62	53·9
10. Percentage by weight of the dry gas. Nitrogen ..	75·56	73·23	75·41	76·3
11. Carbonic oxide	0·49	1·14	..	..
12. Carbonic acid	11·46	22·64	15·04	11·4
13. Oxygen	12·49	2·99	9·55	12·2
14. Air	53·60	12·82	41·00	52·4
15. Carbon in 100 lbs. dry gas in lbs.	3·34	6·66	4·10	3·1
16. Waste gas, not including excess of air in lbs.	4467·	1616·6	1177·	2466·
17. Waste gas per lb. of coal charged in lbs.	11·05	11·70	10·42	12·3
18. Excess of air—total weight in lbs.	5251·	230·	825·70	2976·
19. " " per lb. of coal charged in lbs.	13·0	1·67	7·31	14·8
20. Excess of air in cubic feet per lb. coal	172·9	22·2	97·2	196·8
21. Utilized air per lb. of coal charged in lbs.	10·17	10·75	9·60	11·4
22. Utilized air in cubic feet per lb. of coal.	142·4	150·5	134·4	158·
23. Temperature of air outside ..	20°C	20°	17°	2
24. " " " smoke-box gases	371°	198°	427°	22
25. Heat units (centigrade) lost in escaping carbonic oxide	115,872	50,211	..	..
26. Heat units in waste gas (excess of air excluded)	381,004	69,924	117,264	121,6
27 ——— equal to lbs. of coal ..	*45·9*	*8·42*	*14·13*	*14·*
28. Heat units lost in sensible heat in excess of air	444,187	9866	81,518	145,5
29. ——— equal to lbs. of coal ..	*53·5*	*1·18*	*9·82*	*17·*
30. " " carried away with waste gases and excess of air ..	825,190	79,790	198,782	267,2
31. Heat units used for raising steam, &c.	2,151,962	992,775	599,365	1,390,(
32. Total heat units developed ..	2,977,152	1,072,565	797,147	1,657,

Gases Escaping from Boilers.

		Compound Engines.				
3125.	**3117.**	**3115.**	**3113.**	**3124.**	**3107.**	**3116.**
193·	351·	259·	148·5	168·	202·5	249·
10·	16·	11·75	7·	9·5	7·25	19·5
3·88	4·87	3·54	2·29	3·18	0·83	11·36
0·95	0·95	0·95	0·95	0·94	0·96	0·92
80·10	80·62	80·15	80·03	80·09	80·67	80·33
..	..	0·30	..	..	..	..
8·90	12·00	10·65	14·25	8·55	7·50	8·50
11·00	7·38	8·90	5·72	11·36	11·83	11·17
52·38	35·14	42·38	27·24	54·09	56·33	53·19
75·10	74·71	74·60	73·45	75·20	76·11	75·46
..	..	0·27	..	..	..	..
13·12	17·48	15·65	20·55	12·61	11·13	12·54
11·79	7·81	9·48	6·00	12·19	12·76	12·00
50·55	33·52	40·68	25·74	52·32	54·76	51·50
3·57	4·76	4·50	5·60	3·44	3·01	3·42
2334·	4282·	3124·	1804·6	2034·	2489·	2932·
12·09	12·20	12·06	12·15	12·10	12·29	11·77
2376·	2165·60	2052·	597·5	2230·	3264·	3169·
12·31	6·19	7·92	4·02	13·27	16·10	12·72
163·7	82·3	105·3	53·5	176·5	214·1	169·2
11·14	11·245	11·11	11·20	11·16	11·33	10·85
156·00	157·30	155·5	156·80	156·25	158·6	151·9
18°	18°	18°	24°	20°	20°	20°
196°	249°	360°	224°	210°	238°	371°
..	..	28,456	..	..	..	..
78,315	239,856	259,614	87,723	93,910	131,866	260,087
9·43	*28·89*	*31·72*	*10·57*	*11·31*	*15·89*	*30·13*
96,199	120,582	169,132	28,799	102,112	171,494	268,164
11·59	*14·52*	*20·37*	*3·47*	*12·30*	*20·66*	*32·30*
174,514	360,438	428,746	116,522	196,022	303,360	528,251
396,036	2,513,512	1,663,894	1,097,526	1,172,682	1,370,684	1,446,660
570,550	2,873,950	2,092,640	1,214,048	1,368,705	1,674,044	1,974,911

INDICATOR DIAGRAMS OF ENGINES.

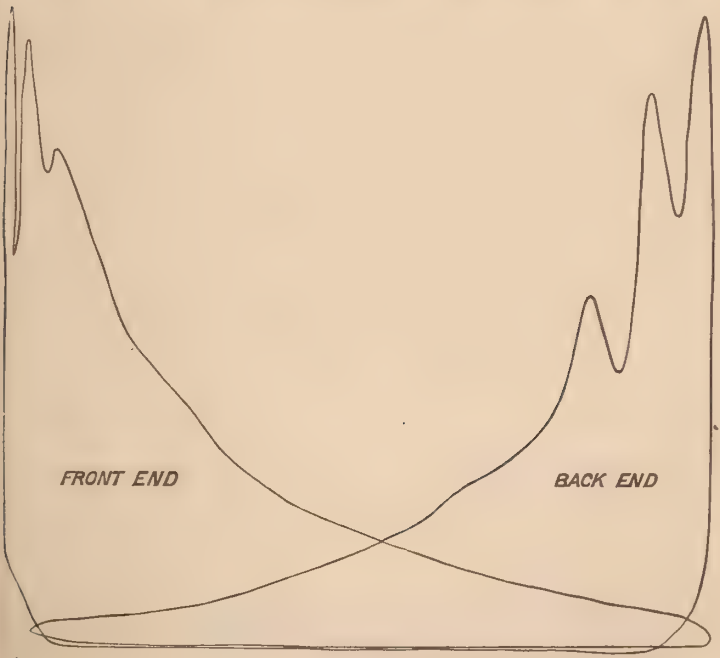
Messrs. Foden and Sons' Simple Traction Engine, No. 3114.

Scale $\frac{1}{48}$.

Messrs. Jeffery and Blackstone's Simple Vertical Portable Engine, No. 147.

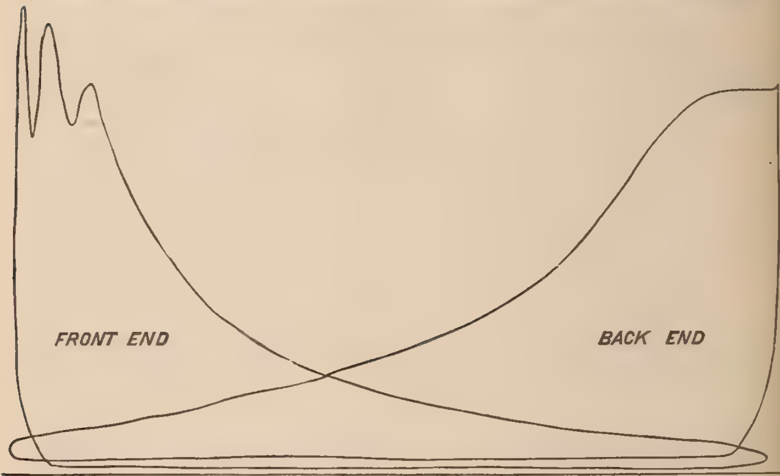
Scale $\frac{1}{48}$.

Messrs. J. and H McLaren's Simple Portable Engine, No. 3108.



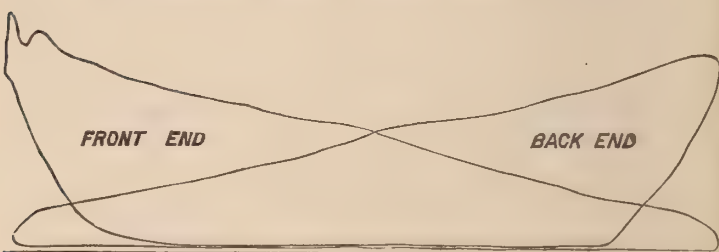
Scale $\frac{1}{48}$.

Messrs. Davey Paxman and Co.'s Simple Portable Engine, No. 3125.



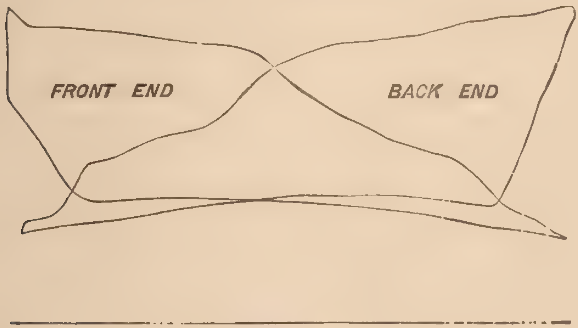
Scale $\frac{1}{48}$.

Mr. Humphries' Simple Portable Engine, No. 3117.



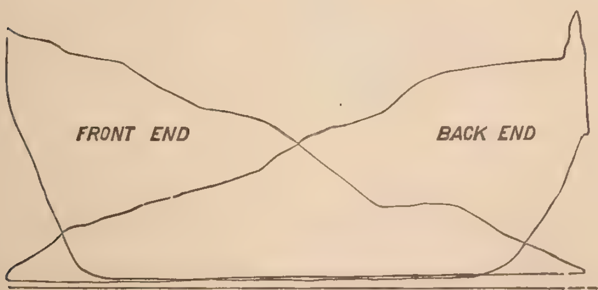
Scale $\frac{1}{48}$.

Mr. Thos. Cooper's Compound Traction Engine, No. 3115—*High Pressure Cylinder.*



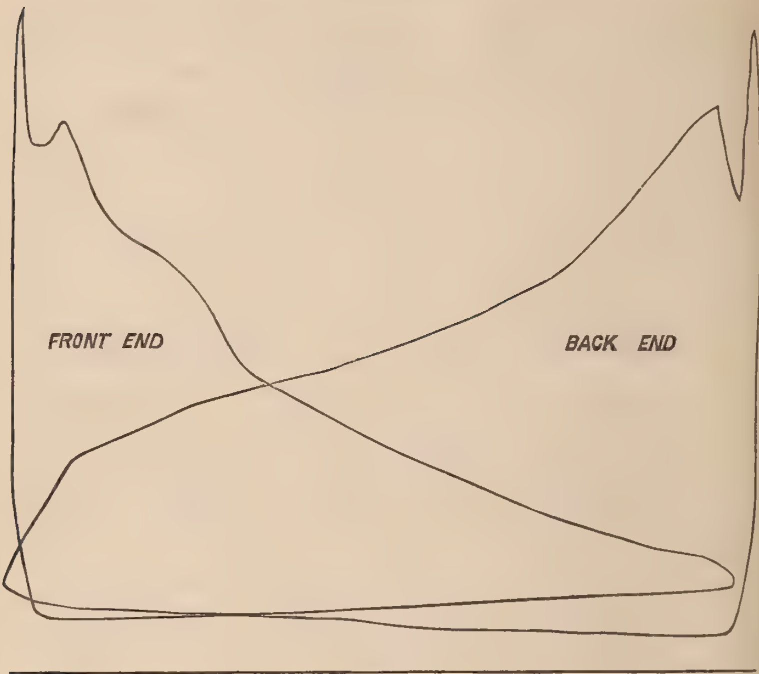
Scale $\frac{1}{64}$.

Mr. Thos. Cooper's Compound Traction Engine, No. 3115—*Low Pressure Cylinder.*



Scale $\frac{1}{32}$.

Messrs. Foden and Sons' Compound Traction Engine, No. 3113—*High Pressure Cylinder.*



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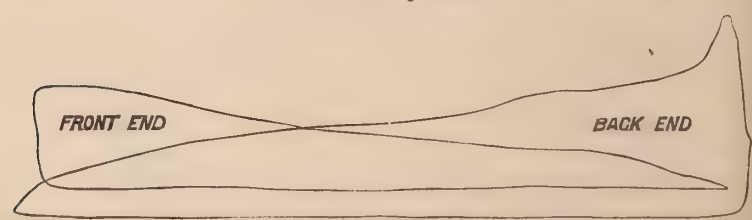
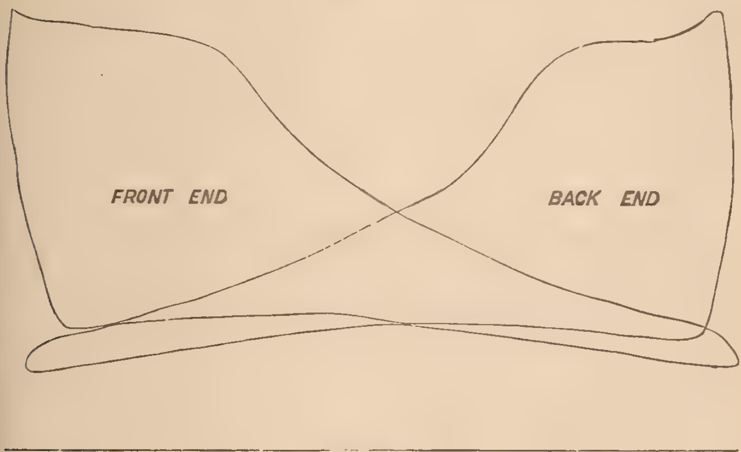
Messrs. Foden and Sons' Compound Traction Engine, No. 3113—*Low Pressure Cylinder.*



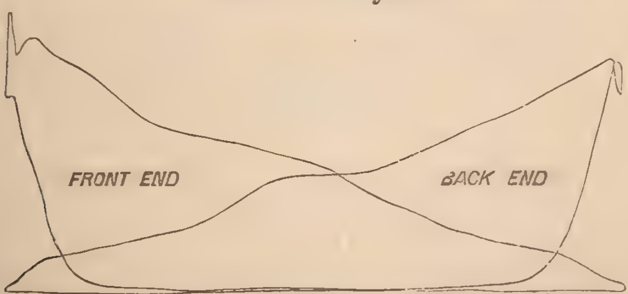
Scale $\frac{1}{32}$.

Messrs. Davey Paxman and Co's Compound Portable Engine, No. 3124 *—High Pressure Cylinder.*



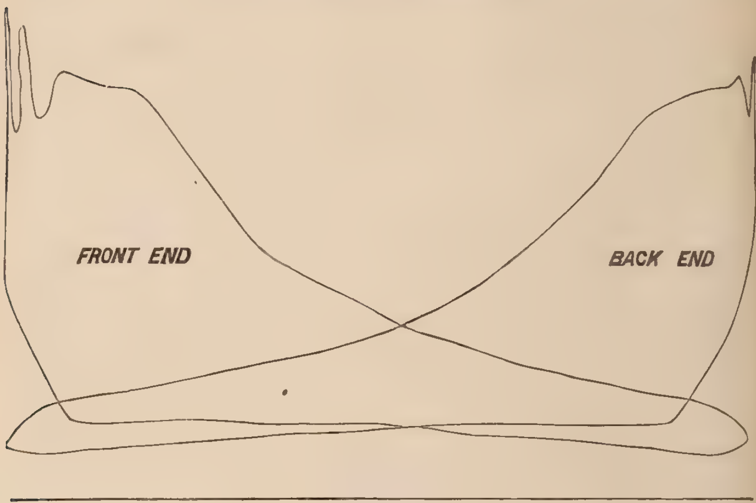
Scale $\frac{1}{64}$.

Messrs. Davey Paxman and Co.'s Compound Portable Engine, No. 3124 *—Low Pressure Cylinder.*



Scale $\frac{1}{32}$.

Messrs. J. and H. McLaren's Compound Portable Engine, No. 3107—
High Pressure Cylinder.

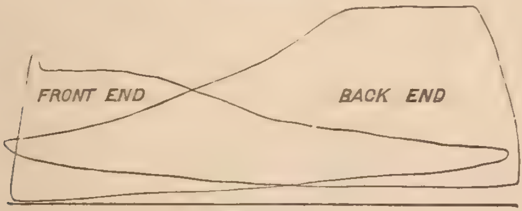


Scale $\frac{1}{64}$.

Messrs. J. and H. McLaren's Compound Portable Engine, No. 3107—
Low Pressure Engine.

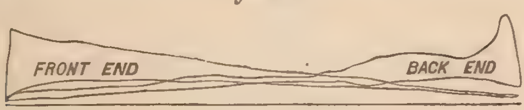
Scale $\frac{1}{32}$

Mr. Humphries' Compound Portable Engine, No. 3116—*High Pressure Cylinder.*



Scale $\frac{1}{64}$.

Mr. Humphries' Compound Portable Engine, No. 3116—*Low Pressure Cylinder.*



Scale $\frac{1}{32}$.

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ASHWORTH, A.
AYLMER, H.
BOWEN-JONES, J.
CHANDOS-POLE-GELL, H.
FOSTER, S. P.
FRANKISH, W.
GILBEY, WALTER.
GORRINGE, H.
HEMSLEY, J.
HOWARD, C.
MAINWARING, C. S.
MARTIN, J.
MILLER, T. H.
RANDELL, C.
SANDAY, G. H.
SCARTH, W. T.
SHERATON, W.
SIMONDS, Professor.
SMITH, A. J.
STRATTON, R.
The Stewards of Live Stock.

Implement Committee.

HEMSLEY, J. (Chairman).
BRIDPORT, Gen. Viscount.
MORETON, Lord.
PARKER, Hon. C. T.
THOROLD, Sir J. H., Bt.
ALLENDER, G. M.
ANDERSON, W.
BOWEN-JONES, J.
CLAY, C.
FRANKISH, W.
GRENVILLE, R. NEVILLE.
HOWARD, C.
HOWARD, J.
LITTLE, H. J.
MARTIN, J.
RANSOME, J. E.
SANDAY, G. H.
SHERATON, W.
STRATTON, R.
WILSON, JACOB.
The Stewards of Implements.

General Nottingham Committee.

THE WHOLE COUNCIL, with the following representatives of the LOCAL COMMITTEE:—

BARRON, J.
FOLJAMBE, F. J. S.
FORD, W.
HODGKINSON, GROSVENOR.
KNOWLES, R. M.
LAMBERT, W.
NOTTINGHAM, MAYOR OF.
NOTTINGHAM, TOWN CLERK OF.
SMITH, HENRY.
WRIGHT, W.

Show-Yard Contracts Committee.

RANDELL, CHARLES (Chairman).
ALLENDER, G. M.
ASHWORTH, A.
CLAY, CHARLES.
FRANKISH, W.
HEMSLEY, J.
HOWARD, C.
SANDAY, G. H.
WILSON, JACOB.

Committee of Selection.

CATHCART, Earl (Chairman).
COVENTRY, Earl of.
EMLYN, Viscount.
ASHWORTH, A.
FOSTER, S. P.
LITTLE, H. J.
PELL, A.

And the Chairmen of the Standing Committees.

Education Committee.

MORETON, Lord (Chairman).
EMLYN, Viscount.
THOROLD, Sir J. H., Bt.
BOWEN-JONES, J.
DENT, J. D.
FOSTER, S. P.
KINGSCOTE, Colonel.
LITTLE, H. J.
MAINWARING, C. S.
PELL, A.
RANSOME, J. E.
SUTTON, M. J.
VOELCKER, Dr.

Dairy Committee.

PARKER, Hon. C. T. (Chairman).
BRIDPORT, Gen. Viscount.
EMLYN, Viscount.
EGERTON OF TATTON, Lord.
THOROLD, Sir J. H., Bt.
ASHWORTH, A.
ALLENDER, G. M.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
GRENVILLE, R. NEVILLE.
MAINWARING, C. S.
SHERATON, W.

Cattle Plague Committee.

THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING.

12, Hanover Square, Monday, May 23rd, 1887.

REPORT OF THE COUNCIL.

The Council regret to announce that the numbers of the Society have been diminished by the resignation of 301 Members, by the death of 1 Governor and 117 Members, and by the removal of 96 Members from the books by order of the Council; but these losses have been in a measure repaired by the election of 214 Members.

The Society now consists of:—

71 Life Governors,
64 Annual Governors,
3440 Life Members,
5387 Annual Members,
20 Honorary Members,

making a total of 8982, and showing a decrease of 301 Members since the last Meeting in December.

The Council deplore the loss of the Secretary and Editor of the Society, Mr. Henry Michael Jenkins, who died on the 24th of December last. In Agriculture he created for himself a great reputation, and a name that will be gratefully remembered, not only by the Members of the Society and at home, but by instructed Agriculturists in the Colonies and on the Continent. Of remarkable ability, grasp and tenacity, combined with proportionate powers of expression, his unflagging zeal was as conspicuous as his world-wide sympathies. Mr. Jenkins was indeed a typical Secretary. The eminent services he

rendered as Editor are worthily and indelibly recorded on the pages of eighteen annual volumes of the Journals of the Society.

Careful that full justice should be done to the memory of their late Secretary, the Council are indebted to the appreciative pen of Mr. John Chalmers Morton, who, for immediate publication in the Society's Journal, has written with every advantage of personal knowledge a very sympathetic Memoir.

In consideration of the premature death of Mr. Jenkins, and the eminent services which he has rendered to the Society, the Council unanimously voted a sum equivalent to a year's salary to be invested for the benefit of his widow and children, and it was referred to the Finance Committee to carry out the details of investment.

The Council having decided that the vacant office of Secretary and Editor should not be filled up immediately, Colonel Kingscote, Chairman of the Finance Committee, was requested to superintend all financial matters with the assistance of Mr. Gale, the Acting Secretary; while Earl Cathcart, Chairman of the Journal Committee, consented to take charge of the editorial work, with such assistance as he might require; and Mr. Jacob Wilson, Honorary Director, undertook a general charge of the secretarial work of the Society, with the assistance of the Acting Secretary and an ample staff of clerks.

To fill the vacant post of Editor and Secretary the Council have elected, from 106 candidates, Mr. Ernest Clarke, whose experience at the Local Government Board and as Assistant Secretary of the Stock Exchange, and whose other acquirements, appear to fit him eminently for that post.

The actual routine business under the experienced direction of Mr. Gale, the Acting Secretary, has meanwhile been ably conducted by the permanent staff. In the production of the current number of the Journal, the Chairman of the Journal Committee did not consider it necessary to seek any extraneous aid, being perfectly satisfied with the assistance rendered by Mr. Charlton, of the Society's office.

The vacancy in the Council caused by the election of Mr. Wakefield, as a Vice-President, has been filled by the election of Mr. Percy E. Crutchley, of Sunninghill Park, Berkshire.

The accounts for the year 1886 having been examined by the

auditors and accountants of the Society, are published in the current number of the Journal. The funded property of the Society remains at 31,895*l.* 5*s.* 7*d.*, while the balance of the current account in the hands of the Society's bankers on the 1st instant was 896*l.* 15*s.*, and 2000*l.* remained on deposit.

In accordance with a resolution of Council passed in November last, an Exhibition of Thoroughbred Stallions was held at Newcastle-on-Tyne on the 25th of January, when 45 Stallions were entered—of which 38 were for competition and 7 for exhibition only. Five horses were selected, to each of which were awarded equal premiums of 200*l.* and a special Gold Medal.

These horses were duly allotted by ballot to special districts in the counties of Northumberland, Durham, Cumberland, and Westmoreland, and District Committees were appointed to superintend all matters connected with the scheme. Applications for the services of these Stallions have been most satisfactory, and far in excess of the expectation of its promoters.

The Newcastle-upon-Tyne Meeting will commence on Monday morning, July 11th, and close on the following Friday evening; but the Implement portion of the Show, as well as the Working Dairy, will be open to Members of the Society and the public on Friday the 8th and Saturday the 9th July.

The last date of entry for Live Stock and Dairy Produce is May 12th, but post entries at double fees will be received up to June 1st. The last date of entry for Poultry is also June 1st.

The Council have decided to continue at Newcastle the examination for efficiency in Butter-making, but, in view of the unsatisfactory nature of the Cheese-making competition, they have determined to discontinue to offer the prizes and certificates for Cheese-makers.

The Working Dairy will be an interesting feature of the Newcastle Show-Yard.

At the Society's Experimental Farm at Woburn, a further series of experiments on Ensilage has been carried out; the principal point under consideration being the respective values of grass when converted into ensilage and when made into hay. A silage stack of grass was also erected, and a feeding trial made with it. During the winter an experiment in sheep-

feeding, akin to that of last year, has also been carried out. Reports of all these experiments will be communicated in the Journal.

As announced in the last Report, four Local Societies (the Essex Agricultural Society, the Norfolk Chamber of Agriculture, the Royal Manchester Liverpool and North Lancashire Society, and the Yorkshire Agricultural Society) had undertaken to conduct practical experiments in Agriculture in conjunction with the Royal Agricultural Society. The several Societies have duly presented their Reports, and a summary of them appears in the current number of the Journal. The same four Societies have expressed their willingness to continue further experiments during 1887.

With reference to the Country Meeting of 1888, an invitation having been received by the Council from the authorities of Nottingham, a Committee of Inspection was appointed to visit the locality, and deputations from Nottingham having had interviews with the Council, after due deliberation it was resolved to hold the Country Meeting of 1888 in that town.

It has been decided that the prizes for Cheese in 1888 shall be for Cheddar, Cheshire, Stilton and Cheese of any other British make, made in 1887.

As 1889 is the Jubilee Year of the Society, it is proposed that the Country Meeting shall then be held in the neighbourhood of the Metropolis, and that the Show for the succeeding year shall still be held in District D.

The examiners of the Royal College of Veterinary Surgeons have reported that of the students from the Royal Veterinary College who have obtained the Diploma of the Royal College of Veterinary Surgeons, the following two passed best and thereby became entitled to the Society's medals :—

Mr. Frank Warren, of Hadlow, Kent.
Mr. Chas. T. Bray, of Highworth, near Swindon.

The Council have granted an annual subsidy of 200*l.* to the Royal Veterinary College, for instruction in Cattle Pathology. They have also granted 50*l.* to Professor Brown, for his investigations into the life-history of the lung-worm in calves and sheep.

The Country still continues free from Foot-and-mouth disease, and Pleuro-pneumonia has much diminished, except in Scotland, where there has been a great increase of cases.

Quarter-ill, or Black-leg, continues to cause considerable loss, and no material progress has been made in the extinction of Swine fever.

Orders of Council relating to Rabies and Anthrax came into force on October 1st, 1886. Since the passing of these Orders, reports of both diseases have been received from the following Counties :—

Anthrax.	Rabies.
England—	*England*—
Bucks.	Berks.
Chester.	Chester.
Derby.	Derby.
Dorset.	Essex.
Essex.	Hants.
Hants.	Herts.
Hereford.	Huntingdon.
Herts.	Kent.
Huntingdon.	Lancaster.
Kent.	Leicester.
Lancaster.	Lincoln, Kesteven.
Leicester.	Middlesex.
Lincoln, Holland.	Notts.
,, Kesteven.	Salop.
,, Lindsey.	Stafford.
Middlesex.	Surrey.
Norfolk.	Sussex, East.
Northampton.	,, West.
Northumberland.	Warwick.
Notts.	Worcester.
Somerset.	York, W.R.
Sussex, East.	Soke of Peterboro'.
Warwick.	The Metropolis.
Wilts.	
York, W.R.	
Isle of Ely.	
Wales—	*Wales*—Nil.
Flint.	
Scotland—	*Scotland*—Nil.
Aberdeen.	
Banff.	
Dumfries.	
Edinbro'.	
Fife.	
Forfar.	
Lanark.	
Linlithgow.	

In reply to a letter addressed by the President to the Lord President of the Privy Council, in reference to an outbreak of Scarlatina, the following communication was received:—

February 28*th*, 1887.

My Lord,—Referring to your Lordship's letter of the 3rd inst., suggesting that the Privy Council should institute an inquiry into the allegations that the milk of cows affected with eruptive disease of the udder and teats may become a medium of conveying the infective matter of human diseases, such as Scarlatina and Diphtheria, without the agency of a diseased human being, I am directed by the Lord President to inform you that his Lordship has given directions that an investigation is to be carried out, as suggested in your Lordship's letter above referred to.

I am, My Lord,
Your Lordship's obedient servant,
(Signed) C. L. Peel.

Lord Egerton of Tatton,
President of the Royal Agricultural Society of England,
12, Hanover Square, W.

A report on the subject has recently been received from the Agricultural Department of the Privy Council.

The Council having received a communication from the Worshipful Company of Farriers asking their opinion on the advisability of opening a Register for the entry therein of the names, addresses, and ages of any Master and Journeyman Farriers who shall pass a practical examination in the art of making shoes for, and shoeing horses, the Council informed them that the course proposed would be beneficial, but that it seemed to them that the Worshipful Company would most advance the purpose which they have at heart, by giving technical instruction in horse-shoeing and by instituting examinations thereon.

The Society have already recognised the importance of a proper knowledge of making shoes and of shoeing horses by the prizes offered at Newcastle.

In the Entomological Section of the Seeds and Plant Diseases Committee, there has been a large increase of interest shown by Members of the Society concerning the attack of various insects upon crops of the farm and garden, and the applications to the Consulting Entomologist for the identification of insects, and for remedies and methods of prevention, have been most numerous. Among other reports furnished by Miss Ormerod, a most comprehensive account of the Mustard Beetle appears in the present number of the Society's Journal. Much attention has been given to the probable spread of the Hessian Fly in the

coming summer, and warnings were issued to farmers to burn, or otherwise dispose of, the screenings and siftings from threshing machines likely to contain the pupa cases of this insect.

The work in the Botanical Section has been considerably more than at this period last year. The general results show a continual improvement in the quality of the seeds examined. The majority of the samples of Foxtail have greatly advanced, both in purity and germination. Rye Grass has almost disappeared as an adulterant in the better grasses.

The Schedule of Members' Botanical Privileges has been revised, and the attention of Members is especially called to this, which is published in the current number of the Journal.

Fourteen candidates entered themselves for the Society's Senior examination, and seven presented themselves on May 10th and following days.

The following candidates, placed in order of merit, obtained First Class Certificates and the Life Membership of the Society, besides qualifying for the prizes stated below:—

Charles Falcon Archibald, College of Agriculture, Downton, 25*l.*

George Carrington, Royal Agricultural College, Cirencester, 15*l.*

John William Pitt Muir-Mackenzie, Royal Agricultural College, Cirencester, 10*l.*

In addition to the above, a Second-class Certificate was gained by Khoshvoo B. Jadhava, Royal Agricultural College, Cirencester.

By order of the Council,

J. GALE,

Acting Secretary.

ROYAL AGRICULTURA

DR. HALF-YEARLY CASH ACCOUN

	£ s. d.	£ s. d.	£ s.
To Balance in hand, 1st January, 1887 :—			
Bankers		720 11 2	
Secretary		56 16 6	
			777 7
To Income :—			
Dividends on Stock		462 9 7	
Interest on Deposit		11 13 11	
Subscriptions :—			
Governors' Annual	210 0 0		
Members' Life-Compositions	539 0 0		
Members' Annual	4,119 9 0		
		4,868 9 0	
Establishment :—			
Rent		200 0 0	
Journal :—			
Sales	85 14 2		
Sale of Pamphlets	3 0 8		
Advertisements	157 9 5		
Col. Picton Turbervill's Essay Prizes	75 0 0		
		321 4 3	
Chemical :—			
Laboratory Fees (one quarter)		76 5 3	
Education :—			
Sale of Insect Diagrams		1 9 9	
Norwich Meeting		23 4 5	
Total Income		.. .. ..	5,964 16
To Newcastle Meeting..		.. .. ..	6,396 18 1
To Stallion Show		.. .. ..	652 9
			£13,791 11

BALANCE-SHEE

LIABILITIES.	£ s. d.	£ s. d.	£ s.
To Capital :—			
Surplus, January 1st, 1887..		37,308 12 7	
Surplus of Income over Expenditure during Half-year, viz. :—	£ s. d.		
Income	5,964 16 2		
Expenditure	4,442 6 8		
		1,522 9 6	
			38,831 2
Deduct half-year's interest and depreciation on Country Meeting Plant		.. .. ..	210 2
			£38,620 19

QUILTER, WELTON, & CO., *Accountants.*

OCIETY OF ENGLAND.

ROM 1ST JANUARY TO 30TH JUNE, 1887. CR.

	£ s. d.	£ s. d.	£ s. d.
3y Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	395 0 0		
House:—Rent, Taxes, Repairs, &c.	366 8 10		
Office:—Printing, Postage, Stationery, &c... ..	416 5 9		
		1,177 14 7	
Journal:—			
Printing and Stitching	659 1 4		
Printing Advertisements	59 16 0		
Postage and Delivery	200 0 0		
Literary Contributions	177 10 0		
Prize Essays	50 0 0		
Woodcuts	17 10 0		
Advertising..	9 14 6		
		1,173 11 10	
Chemical:—			
Salaries	358 15 0		
Apparatus and Chemicals	35 13 6		
Petty Payments	18 4 9		
		412 13 3	
Veterinary:—			
Grant for Experiments	50 0 0		
Grant to Royal Veterinary College	100 0 0		
		150 0 0	
Seeds and Plants Diseases:—			
Consulting Entomologist's Salary	50 0 0		
Consulting Botanist's Salary	50 0 0		
		100 0 0	
Education:—			
Prizes	50 0 0		
Fees to Examiners	36 15 0		
		86 15 0	
Sundries:—			
Expenses of Inspection Committee	20 12 0		
Gratuity to Mrs. Jenkins..	1,300 0 0		
		1,320 12 0	
Subscription paid in error returned		1 0 0	
Norwich Meeting		20 0 0	
Total Expenditure..		.. .. ..	4,442 6 8
y Country Meeting Plant		.. .. ..	22 0 0
y Newcastle Meeting		.. .. ..	8,278 15 9
y Stallion Show		.. .. ..	691 18 10
			13,435 1 3
y Balance in hand, 30th June:—			
Bankers		297 3 9	
Secretary..		59 6 9	
			356 10 6
			£13,791 11 9

TH JUNE, 1887.

ASSETS.	£ s. d.	£ s. d.
y Cash in hand	356 10 6	
y New 3 per Cent. Stock 29,885*l.* 4*s.* 4*d.* cost *	29,177 17 1	
y Consols 2,010*l.* 1*s.* 3*d.* cost †	2,000 0 0	
y Books and Furniture in Society's House	1,451 17 6	
y Country Meeting Plant	2,591 16 1	
		35,578 1 2
At Debit of Newcastle Meeting	2,949 12 1	
" " Stallion Show	93 6 0	
		3,042 18 1
		£38,620 19 3

* *Value at* 102 = 30,482*l.* 18*s.* 4*d.*
† *Value at* 101½ = 2,040*l.* 4*s.* 3*d.*

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscriptions to 30th June, 1887, which at that date amounted to 2,585*l.*

Examined, audited, and found correct, this 29th day of August, 1887.

FRANCIS SHERBORN,
A. H. JOHNSON,
C. GAY ROBERTS, } *Auditors on behalf of the Society.*

NEWCASTLE-UPON-TYNE MEETING, 1887.

STEWARDS OF DEPARTMENTS.

Implements.

H. J. LITTLE.
J. HEMSLEY.
S. P. FOSTER.

Live Stock.

THE EARL OF COVENTRY.
LORD MORETON.
W. H. WAKEFIELD.
T. H. MILLER.

Dairying.

SIR JOHN H. THOROLD, BART.

Poultry.

THE HON. CECIL T. PARKER.

Horse-shoeing.

CHARLES CLAY.

Forage.

HENRY WALLACE.

Finance.

WILLIAM FRANKISH. | G. H. SANDAY.

Honorary Director.

JACOB WILSON.

CONSULTING ENGINEERS.

SIR FREDERICK BRAMWELL, F.R.S., 5, Great George Street, Westminster, S.W.
WILLIAM ANDERSON, 3, Whitehall Place, London, S.W.

JUDGES OF IMPLEMENTS.

Engines.

DANIEL PIDGEON.
HON. C. R. PARSONS.
HENRY YATES.

Miscellaneous.

JAMES A. CAIRD.
JOHN COLEMAN.
J. W. KIMBER.

JUDGES OF STOCK, &c.

HORSES.

Shire.

Hugh Gorringe.
Henry Overman.
Henry Smith.

Clydesdale and Agricultural.

Alexander Burr.
James Picken.
John Thompson.

Suffolks.

William Harvey.
R. H. Wrinch.

Thoroughbreds and Hunters.

T. Harvey D. Bayly.
J. Maunsell Richardson.
Colonel Kingscote, C.B.

Coaching and Cleveland.

C. W. Wilson.
C. B. E. Wright.

Hackneys and Ponies.

Captain H. Festing.
John M. Martin.
William Parker.

CATTLE.

Shorthorn.

George Drewry.
H. Chandos-Pole-Gell.
R. Stratton.

Hereford.

J. Bowen-Jones.
Aaron Rogers.

Devon and Sussex.

Richard Hamshar.
Samuel Kidner.
George Napper.

Red Polled.

Charles Howard.
Robert Walker.

Angus and Aberdeen.

John Grant.
William Whyte.

Galloway.

William Graham.
James Little.

Ayrshire.

Andrew Allan.
James McQueen.

Highland.

Duncan McDiarmid.

Jersey.

Col. C. P. Le Cornu.
William Ashcroft.
Hugh C. Smith.

Guernsey.

Sir J. F. Lennard, Bart.
Rev. F. G. S. Nichol.

Kerry.

Luke Christy.
George Hewson.

Dairy.

W. P. J. Allsebrook.
Thomas Bowstead.

SHEEP.

Leicester, Cotswold, Lincoln, and other Long-woolled.

Robert Garne.
Edward J. Howard.
George Turner.

Oxfordshire Down.

Alex. Blake.
James P. Case.

Shropshire.

Charles Coxon.
P. A. Evans.
Charles Randell.

Southdown.

Robert Breton.
John A. Hempson.

Hampshire, Suffolk, and other Short-woolled.

S. W. Slater.
S. W. Taylor.

Border Leicester.

J. Chrisp.
George Torrance.

Cheviots.

John Clay.
Thomas Elliot.

Black-faced.

John Irving.
R. Paterson.

Herdwick and Lonk.

John Hogarth.
John Ingleby.
John Richardson.

PIGS.

White.

John Angus.
Peter Eden.
R. H. Watson.

Black or any other Colour.

R. Harvey Mason.
Matthew Savidge.

JUDGES OF CHEESE.

George Gibbons. | George Lewis.

JUDGES OF BUTTER.

G. Mander Allender. | T. Carrick.

JUDGES OF POULTRY.

Rev. A. G. Brooks. | Edward Brown. | Capt. H. Heaton.

JUDGES OF HIVES, HONEY, ETC.

J. M. Hooker. | Walter Martin. | W. Raitt.

JUDGES OF HORSE-SHOEING.

J. D. Barford. | R. Brydon. | Clement Stephenson

INSPECTORS OF SHEARING.

W. Jobson. | J. B. Workman.

JUDGES OF FARMS.

Classes 1, 2 and 3 (Arable, Grass, and Hill Farms).

A. Peterkin Hope.
E. F. Jordan.
William C. Little.

Classes 4 and 5 (Dairy and Colliery Farms).

William Priday.
F. Punchard.
Thomas Rigby.

AWARD OF PRIZES.

NOTE.—The Judges were instructed, in addition to awarding the Prizes, to designate as the *Reserve Number* one animal in each Class, next in order of merit, if it possessed sufficient for a Prize; in case an animal to which a Prize was awarded should subsequently become disqualified.

Prizes given by the Newcastle-upon-Tyne Local Committee are marked thus (*).

HORSES.

No in Catalogue. CLASS 1.—*Shire Stallions foaled previous to the Year* 1884.†

5 ALFRED CHARLES DUNCOMBE, Calwick Abbey, Ashbourne, Derbyshire: FIRST PRIZE, 30*l*., and CHAMPION PRIZE, 25*l*.,‡ for "Harold" (3703), brown; was foaled in 1881; bred by Mr. J. H. Potter, The Hall Farm, Spondon, Derby; sire, "Lincolnshire Lad II." (1365); dam, "Flower," by "Champion" (419).

3 A. B. FREEMAN-MITFORD, C.B., Batsford Park, Moreton-in-Marsh, Gloucestershire: SECOND PRIZE, 15*l*., for "Hitchin Conqueror" (4458), bay; was foaled in 1883; bred by Mr. G. S. Shepperson, Lockington, Derby; sire, "William the Conqueror" (2343); dam, "Flower," by "Honest Prince" (1058).

8 THOMAS SHAW, The Island, Winmarleigh, Garstang, Lancashire: THIRD PRIZE, 5*l*., for "Agricola" (2700), grey; was foaled in 1881; bred by Mr. V. Godfrey, Wisbech Fen, Cambridgeshire; sire, "Thumper" (2136); dam, "Darling," by "Samson" (1946).

6 JAMES FORSHAW, Blyth, Worksop, Nottinghamshire: the *Reserve Number* for "Carlton Blaze," late "Stuntney Britain" (3339), bay; was foaled in 1882; bred by Mr. John Starling, Soham Fen, Soham, Cambridgeshire; sire, "Great Britain" (978); dam, by "King of the Country" (1234).

CLASS 2.—*Shire Stallions foaled in the Year* 1884.

11 WALTER GILBEY, Elsenham Hall, Essex: FIRST PRIZE, 25*l*., for "Real Briton" (4641), bay; bred by Mr. V. Eastgate, Holbeach, Lincolnshire; sire, "True Briton" (2684); dam, "Brisk," by "Matchless" (1542).

9 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 15*l*., for "Chieftain," bay; bred by Mr. William Riley, Boulton, Derby; sire, "Champion" (457); dam, by "Waxwork" (2306).

14 CHARLES EDWARD GALBRAITH, Honington Hall, Grantham, Lincolnshire: THIRD PRIZE, 5*l*., for "Don Pedro" (5002), black; bred by Mr. John Morton, Wales Hall, Aston, Yorkshire; sire, "Don Carlos" (2416); dam, by "Masterman" (2464).

† Given by the Mayor of Newcastle-upon-Tyne (Sir B. C. Browne).
‡ Given by the Shire Horse Society for the best Shire Stallion.

16 Thomas Shaw, The Island, Winmarleigh, Garstang, the *Reserve Number* for (5261) "Plutarch," bay; bred by Mr. E. P. Wilson, Cobcut, Droitwich; sire, "Ruler" (4000); dam, "Pandora" (Vol. VIII.).

Class 3.—*Shire Stallions foaled in the Year* 1885.

21 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 25*l.*, for "Don Juan," bay; bred by himself; sire, "Don Carlos" (2416); dam, "Cornflower," by "Lincolnshire Lad II." (1365).

28 Joseph Topham, Thorney Park, Peterborough: Second Prize, 15*l.*, for "Causeway Prince," bay; bred by Mr. T. W. Parnell, The Causeway, Thorney, Peterborough; sire, "Thorney Tom" (3370); dam, "Flower," by "Thumper" (2126).

24 Philip Albert Muntz, M.P., Dunsmore, Rugby, Warwickshire: Third Prize, 5*l.*, for "Derbyshire Hero," black; bred by Mr. William Smith, Alsop-en-le-Dale, Ashbourne, Derbyshire; sire, "Royal Albert" (1885); dam, "Madam," by "Drayman" (650).

30 John Galbraith, Croy Cunningham, Killearn, Stirling: the *Reserve Number* and *Highly Commended* for "Sir Roger 2nd" (5348), dark bay; bred by Mr. R. Middlebrook, Skeltown, Howden; sire, "Lincolnshire Tom" (1367); dam, "Rose," by "Sir Roger."

Class 4.—*Shire Stallions foaled in the Year* 1886.

32 Peter Blundell, Ream Hills, Weeton, Kirkham, Lancashire: First Prize, 15*l.*, for "Premier Fashion," brown; bred by Mr. Samuel Saint, Dairy House, Alkmonton, Derby; sire, "Premier" (2646); dam, by "Tom King" (4752).

41 Thomas Horrocks Miller, Singleton Park, Poulton-le-Fylde, Lancashire: Second Prize, 10*l.*, for "Moloch," bay; bred by Swarbrick Brothers, Hey Houses, Lytham, Lancashire; sire, "Fen Champion" (3085); dam, by "What's Wanted" (2332).

39 W. Burdett-Coutts, M.P., Holly Lodge, Highgate, London: Third Prize, 5*l.*, for "The Baron," late "Leake Jubilee," bay; bred by Mr. John German, Huntingdon House, Ashby-de-la-Zouch, Leicestershire; sire, "Black Prince" (2989); dam, "Gratitude," by "Appleby Champion."

35 Lord Egerton of Tatton, Tatton Park, Knutsford, Cheshire: the *Reserve Number* for "Kit O'Lincoln," bay; bred by Mr. James Swarbrick, Upper Rawcliffe, Garstang, Lancashire; sire, "Lincoln" (1350); dam, "Kitty," by "Honest John" (1054).

Class 5.—*Clydesdale Stallions foaled previous to the Year* 1884.*

48 Peter Crawford, Eastfield, Dumfries: First Prize, 30*l.*, for "The Milroy" (4574), bay; was foaled in 1883; bred by Mr. James Milroy, Galdenoch, Stranraer, Wigtonshire; sire, "Master Lyon" (2288); dam, "Mary of Galdenoch" (2535), by "Old Times" (579).

46 David Riddell, Blackhall, Paisley, N.B.: Second Prize, 15*l.*, for "Duke King," brown; was foaled in 1883; bred by Mr. Charlton, Shaw House, Stocksfield-on-Tyne, Northumberland; sire, "Merry Monarch"; dam, "Nanny," by "Hamilton Jock."

51 Alexander McCowan, Newtonairds, Dumfries: Third Prize, 5*l.*, for "Prince of Airds" (4641), brown; was foaled in 1883; bred by Mr. Webster, Airds, New Galloway, Kirkcudbrightshire; sire, "Good Hope"; dam, "Dina of Airds."

49 SIR JAMES DUKE, Bart., Laughton, Hawkhurst, Sussex: the *Reserve Number* for "King Lawrence" (4175), black; was foaled in 1883; bred by the Marquis of Londonderry, Seaham Harbour, Co. Durham; sire, "King of the Clans"; dam, "by Lucy," "Tifter."

CLASS 6.—*Clydesdale Stallions foaled in the Year* 1884.

57 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, N.B.: FIRST PRIZE, 25*l*., and CHAMPION PRIZE, 21*l*.,§ for "Sirdar" (4714), brown; bred by Mr. Alexander Baird, Urie, Stonehaven, Aberdeenshire; sire, "Darnley" (222); dam, "Concetta" (6), by "The Earl" (862).

56 DAVID RIDDELL, Blackhall, Paisley, N.B.: SECOND PRIZE, 15*l*., for "Craigie," bay; bred by Mr. R. F. Campbell, M.P., Craigie House, Ayr; sire, "Darnley"; dam, by "Largs Jock."

55 JAMES LITTLE, Bowness-on-Solway, Cumberland: THIRD PRIZE, 5*l*., for "Lord Lothian," brown; bred by Mr. James McClean, Auchneil, Stranraer; sire, "Top Gallant" (1850); dam, "Jessie Rankin" (3855), by "Lord Lyon" (489).

53 GEORGE RODGER, Newton Bank, Preston Brook, Cheshire: the *Reserve Number* for "Briglands" (4269), bay; bred by himself; sire, "Mystic" (2298); dam, "Bonnie Lassie" (2896), by "Bonnie Scotland" (1076).

CLASS 7.—*Clydesdale Stallions foaled in the Year* 1885.

68 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, N.B.: FIRST PRIZE, 25*l*., for "Macaulay" (5187), brown; bred by Mr. Mark J. Stewart, M.P., Southwick, Dumfries, N.B.; sire, "MacGregor" (1487); dam, "Lady Baillie" (4154), by "Pointsman" (1500).

71 JAMES CRAWFORD, Brydekirk Mains, Annan, Dumfriesshire: SECOND PRIZE, 15*l*., for "The Granite City" (5397), bay; bred by Mr. David Walker, Coullie, Udny, Aberdeenshire; sire, "Lord Erskine" (1744); dam, "Bee" (919), by "Old Times" (573).

76 JOHN GALBRAITH, Croy Cunningham, New Killearn, Stirling: THIRD PRIZE, 5*l*., for "Lord Ailsa," bay; bred by Mr. William Gall, Smiddyburn, Rothie Norman, Aberdeen; sire, "Lord Erskine" (1744); dam, by "Prince of Wales" (673).

74 THE EARL OF CAWDOR, Stackpole Court, Pembroke: the *Reserve Number* and *Highly Commended* for "Thane of Cawdor" (5388), bay; bred by Mrs. Mordoch, Haughhead Farm, Uddingston, Lanarkshire; sire, "St. Lawrence" (3220); dam, "Scottish Queen," by "Time-o'-day" (875).

CLASS 8.—*Clydesdale Stallions foaled in the Year* 1886.

84 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, N.B.: FIRST PRIZE, 15*l*., for "Baron of Cally," bay; bred by Mr. James Hamilton, Boreland, Gatehouse, Kirkcudbrightshire; sire, "Lord Marmion" (2620); dam, "Jess of Newton" (765), by "Dandy Jim" (221).

80 LORDS A. AND L. CECIL, Orchardmains, Innerleithen, Peeblesshire: SECOND PRIZE, 10*l*., for "Cawnpore," bay; bred by themselves; sire, "Lucknow" (3810); dam, "Cornflower," by "Lord Lyon" (489).

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§ Given by the Clydesdale Horse Society for the best Clydesdale Stallion.

87 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour: THIRD PRIZE, 5*l.*, for his brown; bred by himself; sire, "Castlereagh"; dam, "Melona," by "Prince of Wales."

79 JOHN KERR, Red Hall, Wigton, Cumberland: the *Reserve Number* and *Highly Commended* for "The Doctor," bay; bred by Mr. William Parkin, Blaithwaite House, Carlisle; sire, "The Bishop" (1542); dam, "Beauty" (627), by "Lothian Tom" (1211).

CLASS 9.—*Suffolk Stallions foaled in the Year* 1884.

93 ALFRED JAMES SMITH, Rendlesham, Woodbridge, Suffolk: FIRST PRIZE, 25*l.*, for "Blazer," chestnut; bred by Mr. Frank Garrett, Aldringham House, Saxmundham, Suffolk; sire, "Cupbearer III." (566); dam, "Kirton Duchess" (1138), by "Monarch" (1348).

94 MANFRED BIDDELL, Playford, Ipswich, Suffolk: SECOND PRIZE, 15*l.*, for "Pioneer" (1495), chestnut; bred by Mr. Freeman, Stonham Aspall, Ipswich; sire, "Vanguard" (1327); dam, "Matchet" (1232), by "Captain Snap" (142).

CLASS 10.—*Suffolk Stallions foaled in the Year* 1885.

102 HORACE WOLTON, Newbourn Hall, Woodbridge: FIRST PRIZE, 20*l.*, for "Emperor" (1611), chestnut; bred by himself; sire, "Diadem" (1553); dam, "Empress of Paris" (1033), by "Royal Duke II." (1366).

101 JAMES TOLLER, Blaxhall, Wickham Market, Suffolk: SECOND PRIZE, 10*l.*, for "Salisbury," chestnut; bred by Mr. J. Hempson, Shotley, Ipswich; sire, "Statesman" (657); dam, "Moggy" (463), by "Royal Prince" (190).

97 SAMUEL TOLLER, Letheringham, Wickham Market, Suffolk: THIRD PRIZE, 5*l.*, for "Nonpareil" (1602), chestnut; bred by himself; sire, "Chieftain" (1354); dam, "Duchess" (928), by "Prince Imperial" (1239).

98 ALFRED JAMES SMITH, Rendlesham, Woodbridge: the *Reserve Number* for "Duke of May" (1621), chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "May Queen" (837), by "Prince Imperial" (1239).

CLASS 11.—*Agricultural Stallions, not qualified to compete as Shire, Clydesdale, or Suffolk.**

107 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: FIRST PRIZE, 25*l.*, for "Castlereagh" (91), brown; was foaled in 1882; bred by himself; sire, "Darnley"; dam, "Nelly," by "Prince of Wales."

106 THOMAS SHAW, The Island, Winmarleigh, Garstang, Lancashire: SECOND PRIZE, 15*l.*, for "The Mikado," bay; was foaled in 1883; breeder unknown.

108 T. J. and M. PATTISON, Derwent Crook, Gateshead-on-Tyne: THIRD PRIZE, 5*l.*, for "Pioneer," bay; was foaled in 1883; bred by Mr. John R. Pattison, Heworth House, Aycliffe, Darlington, Co. Durham; sire, "Stainton Hero"; dam, by "All Glory."

103 MAJOR GODMAN, Smeaton Manor, Northallerton, Yorkshire: the *Reserve Number* for "Afghan," bay; was foaled in 1883; bred by himself; sire, "South Western" (3209); dam, by "The Banker" (241).

CLASS 12.—*Thorough-bred Stallions.**

112 W. BURDETT-COUTTS, M.P., Holly Lodge, Highgate, London: FIRST PRIZE, 50*l.*, for "Truefit," chestnut; was foaled in 1880; bred by the late Mr. C. Snewing, Holywell Farm, Watford, Herts; sire, "Outfit"; dam, "Eleonora," by "Wild Dayrell."

111 THE COMPTON STUD COMPANY, Sherborne, Dorset: SECOND PRIZE, 20*l.*, for "Huguenot," chestnut; was foaled in 1878; bred by Mr. Constable; sire, "Lowlander"; dam, "Eurydice," by "Orpheus."

113 WILLIAM STEEL, Camerton Stud Farm, Workington, Cumberland: THIRD PRIZE, 10*l.*, for "Blue Grass," chestnut; was foaled in 1880; bred by Mr. A. J. Alexander, Woodburn Stud, Kentucky, U.S.A.; sire, "Pat Molloy"; dam, "Amy Farley," by "Planet."

118 WALTER GILBEY, Elsenham Hall, Essex: the *Reserve Number* for "Pedometer," brown; was foaled in 1872; bred by Baron Meyer de Rothschild, Mentmore, Bucks; sire, "King Tom"; dam, "Miss Peddie," by "Poynton."

CLASS 13.—*Coaching or Cleveland Stallions.*

121 W. BURDETT-COUTTS, M.P., Holly Lodge, Highgate, London: FIRST PRIZE, 20*l.*, for "Sultan" (667), bay; was foaled in 1884; bred by Mr. George Leefe, Fryton, Slingsby, Yorkshire; sire, "Emperor" (587).

120 MAJOR GODMAN, Smeaton Manor, Northallerton, Yorkshire: SECOND PRIZE, 10*l.*, for "Guardsman," bay; was foaled in 1885; bred by Mr. Isaac Scarth, Mount Pleasant, East Rounton, Northallerton; sire, "Prince of Cleveland," late "Blooming Heather" (647); dam, "Darling," by "Salesman" (272).

137 HENRY RICHARD WOOD HART, Ivy Cottage, Dunnington Lodge, Dunnington, Yorkshire: THIRD PRIZE, 5*l.*, for "Wonderful Lord," bay; was foaled in 1878; bred by Mr. William Robinson, Thoranaby Hall, Thirsk, Yorkshire; sire, "Cawston"; dam, by "Wonderful Lad."

130 GEORGE BURTON, Thorpe Willoughby, Selby: the *Reserve Number* for "Prince George," bay; was foaled in 1881; bred by himself; sire, "Prince of Wales"; dam, "Wyndham."

CLASS 14.—*Hackney Stallions above 15 hands.*

141 THOMAS REED, Woodhouse, Beeford, Hull, Yorkshire: FIRST PRIZE, 20*l.*, for "Buckrose" (1629), bay; was foaled in 1884; bred by himself; sire, "County Member" (948).

144 WALTER GILBEY, Elsenham Hall, Essex: SECOND PRIZE, 10*l.*, for "Volunteer" (1217), chestnut; was foaled in 1883; bred by Mr. J. H. Hastings, Bintry, East Dereham, Norfolk; sire, "Model" (1054); dam, "Polly," by "Birdcatcher."

142 THOMAS SHAW, The Island, Winmarleigh, Garstang: the *Reserve Number* for "Star of the North" (802), brown; was foaled in 1880; bred by Mr. Thomas Cook, Kingston-on-Hull, Yorkshire; sire, "Sir Charles" (727); dam, "Portia," by "Bay President."

CLASS 15.—*Hackney Stallions above 14 hands, and not exceeding 15 hands.*

148 JOHN ROBINSON, Cleavland House, Coltman Street, Hull: FIRST PRIZE, 20*l.*, for "Young Lord Derby," dark chestnut; was foaled in 1884; bred by Mr. T. Stephenson, Ulrome, Yorks; sire, "Lord Derby 2nd."

145 Alfred Lewis, Heacham, Lynn, Norfolk: Second Prize, 10*l.*, for "Confidential" (1379), bay; was foaled in 1883; bred by Mr. John Morton, Fences Farm, Stow Bardolph, Downham Market, Norfolk; sire, "Confidence" (158).

147 William R. Trotter, South Acomb, Stocksfield-on-Tyne: the *Reserve Number* for "Young Perfection," brown; was foaled in 1874; bred by Mr. J. Utting, Melton Parva, Norwich; sire, "Old Perfection"; dam, by "Don Carlos."

Class 16.—*Pony Stallions above* 12 *hands, and not exceeding* 14 *hands.*

150 Christopher W. Wilson, Rigmaden Park, Kirkby Lonsdale, Westmoreland: First Prize, 15*l.*, for "Little Wonder 2nd," brown; was foaled in 1883; bred by himself; sire, "Little Wonder," alias "Young Confidence" (1237); dam, "Snorer," by "Sir George" (778): and
151 Second Prize, 10*l.*, for 151, "Pomfret Wonder," black; was foaled in 1880; bred by Mr. G. Wright, Park Lane, Doncaster; sire, "Little Wonder" (C. W. Wilson's); dam, by "Sir George."

Class 17.—*Pony Stallions not exceeding* 12 *hands.**

155 The Marquis of Londonderry, Seaham Hall, Seaham Harbour: First Prize, 15*l.*, for "Auchendennan," black; was foaled in 1881; bred by Mr. J. M. Martin, Auchendennan, Balloch, Dumbartonshire; sire, "Mars."

154 Lords A. and L. Cecil, Orchardmains, Innerleithen, Peeblesshire: Second Prize, 10*l.*, for "Tommy," bay; age and breeder unknown.

153 Henry Davidson, White Lion Brewery, Newcastle-on-Tyne: the *Reserve Number* for "Prince," black; was foaled in 1882; breeder unknown.

Class 18.—*Shire Mares and Foals.*

157 The Earl of Ellesmere, Worsley Hall, Manchester: First Prize, 20*l.*, and the Champion Prize, 25*l.*,‡ for "Miss Stonton," bay; was foaled in 1880 (foal by "Premier" (2646)); bred by Mr. G. Chapman, Langham Lodge, Oakham; sire, "Stonton" (2065); dam, by "Glendon" (934).

164 Robert Millington Knowles, Colston Bassett Hall, Bingham, Nottinghamshire: Second Prize, 10*l.*, for "Pride of Colston," black; was foaled in 1880 (foal by "Esquire" (2774)); bred by Mr. W. H. L. Clare, 33, Friar Lane, Leicester; sire, "Ace of Trumps" (17); dam, "Diamond," by "Nonpareil" (1652).

159 Walter Gilbey, Elsenham Hall, Essex: Third Prize, 5*l.*, for "Startling," roan; was foaled in 1881 (foal by "Spark" (2497)); bred by himself; sire, "Champion" (2410); dam, "Evening Star," by "Major" (1467).

163 The Hon. E. K. W. Coke, Longford Hall, Derbyshire: the *Reserve Number* and *Highly Commended* for "Cinderella," black; was foaled in 1872 (foal by "Charter" (2740)); bred by Mr. Badwick, Bierton, Aylesbury, Buckinghamshire; sire, "Black Prince" (166).

‡ Given by the Shire Horse Society for the best Shire Mare or Filly in Classes 18, 28, 29 and 30.

CLASS 19.—*Clydesdale Mares and Foals.*

168 JOHN GILMOUR, Montrave, Leven, Fifeshire: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 21*l.*,§ for "Moss Rose," bay; was foaled in 1881 (foal by "Garnet Cross" (1662)); bred by Mr. George Ure, Wheatlands, Bonnybridge, Stirlingshire; sire, "Dunmore Prince Charlie" (634); dam, "Rosebud" (1814), by "Time of Day."

171 R. AND J. FINDLAY, Springhill, Baillieston, Lanarkshire: SECOND PRIZE, 10*l.*, for "Chrystal" (5387), brown; was foaled in 1882 (foal by "Master of Blantyre" (2283)); bred by themselves; sire, "Darnley" (222); dam, "Skerblin," by "Lorne" (499).

176 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: THIRD PRIZE, 5*l.*, for "Dora" (4753), brown; was foaled in 1879 (foal by "Castlereagh" (91)); bred by the Keir Trustees, Keir Mains, Dunblane, Perthshire; sire, "Newstead"; dam, "Fanny," by "Tintock."

173 THE DUKE OF PORTLAND, Welbeck Abbey, Worksop, Notts: the *Reserve Number* and *Highly Commended* for "Rosewater," bay; was foaled in 1882 (foal by "Cairnbrogie Keir" (1993)); bred by Mr. R. Frederick, Drumflower, Dunragit, Wigtownshire; sire, "Lord Lyon" (489); dam, "Nell of Drumflower" (520), by "Farmer" (286).

CLASS 20.—*Suffolk Mares and Foals.*

177 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: FIRST PRIZE, 20*l.*, for "Gandy Poll" (1606), chestnut; was foaled in 1881 (foal by "The Wanderer" (1463)); bred by himself; sire, "Statesman" (657); dam, "Smart" (430), by "Emperor" (279).

178 ALFRED J. SMITH, Rendlesham, Woodbridge, Suffolk: SECOND PRIZE, 10*l.*, for "Charsfield Lass" (1558), dark chestnut; was foaled in 1883 (foal by "Prince of May" (1586)); bred by Mr. J. Youngman, Charsfield, Wickham Market; sire, "Field Marshal" (1106); dam, "Depper" (1125), by "Royal Duke" (1279).

CLASS 21.—*Agricultural Mares and Foals, not qualified to compete as Shire, Clydesdale, or Suffolk.**

179 EDWARD CHARLTON, Shaw House, Stocksfield-on-Tyne: FIRST PRIZE, 20*l.*, for "Queen of Tyne," bay; was foaled in 1879 (foal by "Merry Monarch" (538)); bred by himself; sire, "The Chief" (857); dam, "Diamond," by "All Glory."

CLASS 22.—*Hunter Mares and Foals.*

188 W. B. BINGHAM, Cowley Manor, Cheltenham, Gloucestershire: FIRST PRIZE, 20*l.*, for his chestnut (foal by "Rattle"); age, breeder, and pedigree unknown.

184 MAJOR THWAITES, Chevin Grange, Menston, Leeds: SECOND PRIZE, 10*l.*, for "Marion," chestnut, aged (foal by "Knight Templar"); bred by the late Mr. Hudson, Brigham, Lowthorpe, Hull; sire, "Grandmaster"; dam, "Miss Williams," by "General Williams."

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§ Given by the Clydesdale Horse Society for the best Clydesdale Mare or Filly in Classes 19, 31, 32 and 33.

182 Jacob William Annett, Togston Hall, Acklington, Northumberland: Third Prize, 5*l.*, for "Bertha," brown (foal by "Haphazard"); age and breeder unknown; sire, "Gamester"; dam, by "Chainbearer."

183 George H. Spraggon, Nafferton, Stocksfield-on-Tyne: the *Reserve Number* for "Irish Lass," grey; was foaled in 1873 (foal by "Pursebearer"); breeder unknown.

Class 23.—*Coaching or Cleveland Mares and Foals.*

191 Frederick Wilson Horsfall, Potts Grange, Northallerton, Yorkshire: First Prize, 15*l.*, for "Bonny" (14), bay, aged (foal by "Fidius Dius"); bred by Mr. T. Goodrick, Sowerby, Thirsk, Yorkshire; sire, "Luck's All" (188); dam, by "Salesman" (271).

190 John Lett, Scampston, York: Second Prize, 10*l.*, for "Daisy," bay; was foaled in 1882 (foal by "Lord Mulgrave" (742)); bred by himself; sire, "The General"; dam, "Daisy," by "Pottinger."

Class 24.—*Hackney Mares and Foals above* 14 *hands* 2 *inches.*

197 Mrs. Mackie, Auchencairn, Castle Douglas, Kircudbrightshire: First Prize, 15*l.*, for "Lady Watton II." (470), chestnut; was foaled in 1881 (foal by "Lord Derby II." (417)); bred by Mr. T. Nicholson, The Grange, Watton, Hull; sire, "Denmark" (177); dam, "No. 20 Belle," by "Fireaway" (242).

196 Arthur Fewson, Hedon, Hull, Yorkshire: Second Prize, 10*l.*, for "Lily" (219), chestnut; was foaled in 1882 (foal by "Confidence" (163)); bred by himself; sire, "Lord Derby II." (417); dam, "Polly" (279), by "Charley" (129).

192 Henry Moore, Burn Butts, Cranswick, Hull: Third Prize, 5*l.*, for "Frisk" (439), brown; was foaled in 1883 (foal by "Cannon Ball" (113)); bred by himself; sire, "Lord Derby" (417); dam, "Princess" (289), by "Denmark" (177).

198 John Gladstone Mackie, Auchencairn, Castle Douglas: the *Reserve Number* and *Highly Commended* for "Lady Wilton" (478), brown, aged (foal by "Lord Derby II." (417)); bred by Mr. Wilson; sire, "Charley Merry Legs"; dam, by "Tom Thumb."

Class 25.—*Hackney Mares and Foals above* 13 *hands* 2 *inches, and not exceeding* 14 *hands* 2 *inches.*

201 Lieut.-Col. T. Holme Parker, Warwick Hall, Carlisle: First Prize, 15*l.*, for "Nelly Bligh," bay; was foaled in 1875 (foal by "Sir George" (778)); bred by Mr. Henry Persse, Glenarde, Galway; sire, "Thomastown."

203 William R. Trotter, South Acomb, Stocksfield-on-Tyne: Second Prize, 10*l.*, for "Lucy," bay; was foaled in 1870 (foal by "Young Perfection"); breeder unknown.

200 The Aylesbury Dairy Company, Horsham, Sussex: the *Reserve Number* for "Rosie," brown (foal by "Fascination" (1879)); age and breeder unknown.

CLASS 26—*Pony Mares and Foals above 12 hands, and not exceeding 13 hands 2 inches.*

205 LORDS A. AND L. CECIL, Orchardmains, Innerleithen, Peeblesshire: FIRST PRIZE, 15*l.*, for "Podgy," grey; was foaled in 1876 (foal by "Jack Sheppard" (1293)); bred by themselves; sire, "Pasha"; dam, "Foxie."

CLASS 27.—*Pony Mares and Foals not exceeding 12 hands.**

206 LORDS A. AND L. CECIL, Orchardmains, Innerleithen: FIRST PRIZE, 15*l.*, for "Ballantyne," black (foal by "Tommy"); age and breeder unknown.

CLASS 28.—*Shire Fillies foaled in the Year* 1884.

208 WILLIAM BOUCH, Ashorne, Leamington, Warwickshire: FIRST PRIZE, 15*l.*, for "Wildflower," brown; bred by himself; sire, "Reality" (2882); dam, "Hitchin Flower," by "Tom of the Shires" (2682).

213 WALTER GILBEY, Elsenham Hall, Essex: SECOND PRIZE, 10*l.*, for "Shire Style," black; bred by Mr. John Pearson, Nateby, Garstang, Lancashire; sire, "Lincoln" (1350); dam, "Jewel," by "Matchless" (3562).

210 THE EARL OF ELLESMERE, Worsley Hall, Manchester: THIRD PRIZE, 5*l.*, for "Blackpool," black; bred by Mr. Peter Blundell, Kirkham, Lancashire; sire, "Bar None" (2388); dam, "Black Depper," by "Sir Colin" (2022).

209 RICHARD BRADE, Banks, Southport, Lancashire: the *Reserve Number* and *Highly Commended* for "Susanna," chestnut; bred by Mr. Richards, Green Hall, Llanfyllin, Montgomeryshire; sire, "Adam" (65); dam, "Roxana," by "England's Wonder" (761).

CLASS 29.—*Shire Fillies foaled in the Year* 1885.

230 LORD MIDDLETON, Birdsall House, York: FIRST PRIZE, 15*l.*, for "Silver Queen," grey; bred by Mr. J. C. Allen, Cole Green House, Hertford; sire, "Thumper" (2136); dam, "Judy," by "Napoleon" (1604).

222 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 10*l.*, for his black; bred by himself; sire, "Don Carlos" (2416); dam, "Lady Lincoln," by "Lincolnshire Lad II." (1365).

225 PHILIP ALBERT MUNTZ, M.P., Dunsmore, Rugby, Warwickshire: THIRD PRIZE, 5*l.*, for "Pride of Dunsmore," chestnut; bred by himself; sire, "Canute" (2736): dam, "Lively," by "Lofty" (1420): and the *Reserve*
226 *Number* and *Highly Commended* for 226, "Eleanor Letitia," bay; bred by Mr. Gilbert, Swinford Lodge, Rugby; sire, "Canute" (2736); dam, "Hipwell's Bonny," by "Black Legs" (146).

CLASS 30.—*Shire Fillies foaled in the Year* 1886.

232 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 15*l.*, for his bay; sire, "Briton's Boast" (3004); dam, "Lady Lincoln," by "Lincolnshire Lad II." (1365): and SECOND PRIZE, for 231, bay;
231 sire, "Ambassador" (3428); dam, "Sweetbriar," by "William the Conqueror" (2343); both bred by himself.

237 PHILIP ALBERT MUNTZ, M.P., Dunsmore, Rugby, Warwickshire: THIRD PRIZE, 5*l.*, for "Gem of Dunsmore," bay; bred by himself; sire, "Canute" (3736); dam, "Diamond," by "England's Glory" (745).

CLASS 31.—*Clydesdale Fillies foaled in the Year* 1884.

241 ROBERT PATERSON, Robgill Tower, Ecclefechan, Dumfriesshire: FIRST PRIZE, 15*l.*, for "Laura Lee," brown: bred by Mr. D. A. Hood, Balgreddan, Kirkcudbright; sire, "Darnley" (222); dam, "Maggie" (781), by "Farmer" (286).

242 THE DUKE OF PORTLAND, Welbeck Abbey, Worksop, Notts: SECOND PRIZE, 10*l.*, for "Dagmar," bay; bred by Mr. James Drew, Nether Barr, Newton-Stewart, N.B.; sire, "Macgregor" (1487); dam, "Dorothy" (734), by "Disraeli" (234).

248 THE EARL OF CAWDOR, Stackpole Court, Pembroke: THIRD PRIZE, 5*l.*, for "Dewdrop," bay; bred by Mr. James Kilpatrick, Craigie Mains, Kilmarnock, Ayrshire; sire, "Prince of Wales" (673); dam, "Grace Darling" (2432), by "Lord Lyon" (489).

238 JAMES HUNTER, Braehead House, Cathcart, Renfrewshire: the *Reserve Number* and *Highly Commended* for "Lady Blantyre," brown; bred by Mr. A. McVicar, Woodend, Bathgate, Linlithgow; sire, "Master of Blantyre" (2283); dam, "Darling" (1612), by "Earl of Buchan" (264).

CLASS 32.—*Clydesdale Fillies foaled in the Year* 1885.

250 JOHN GILMOUR, Montrave, Leven, Fifeshire: FIRST PRIZE, 15*l.*, for "Montrave Lady," bay; bred by Mr. Duguld McKinnon, Poteath, West Kilbride, Ayrshire; sire, "Top Gallant" (1850); dam, "Fanny of Poteath" (3909), by "Paisley Jock" (581).

253 JAMES MCQUEEN, Crofts, Dalbeattie, N.B.: SECOND PRIZE, 10*l.*, for "Cherry Blossom," brown; bred by Mr. W. P. Gilmour, Balmangan, Borgue, Kirkcudbrightshire; sire, "Macgregor" (1487); dam, "Maggie of Balmangan" (2266), by "Prince Albert" (616).

254 EDWARD CHARLTON, Shaw House, Stocksfield-on-Tyne: THIRD PRIZE, 5*l.*, for "Black Bess," black; bred by himself; sire, "Merry Monarch" (538); dam, "Nanny" (2012), by "Hamilton Jock" (1151).

252 LORDS A. AND L. CECIL, Orchardmains, Innerleithen, N.B.: the *Reserve Number* and *Highly Commended* for "Columbine," bay; bred by themselves; sire, "Auld Reekie" (1920); dam, "Lady Salisbury" (4479), by "Lord Salisbury" (1205).

CLASS 33.—*Clydesdale Fillies foaled in the Year* 1886.

269 JOHN GILMOUR, Montrave, Leven, Fifeshire: FIRST PRIZE, 15*l.*, for "Primrose," bay; bred by Mr. D. A. Hood, Balgreddan, Kirkcudbright; sire, "Darnley" (222); dam, "Maggie of Balgreddan" (781), by "Farmer" (286).

267 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, N.B.: SECOND PRIZE, 10*l.*, for his brown; bred by Mr. R. D. Barre Cunninghame, Hensol, New Galloway, N.B.: sire, "Macgregor" (1487); dam, "Dora" (499), by "Gleniffer" (361).

265 JAMES MCQUEEN, Crofts, Dalbeattie, N.B.: THIRD PRIZE, 5*l.*, for "Judy," brown; bred by Mr. J. McKean, Barmark, Corsock, Dalbeattie; sire, "Macgregor" (1487); dam, "Nelly" (702), by "Dandy Jim" (221).

266 ANDREW BAIRD MATTHEWS, the British Linen Bank, Newtonstewart, Wigtownshire: the *Reserve Number* and *Highly Commended* for "Top Blossom," brown; bred by Mr. T. Muir, Challock, Newtonstewart; sire, "Topgallant" (1850); dam, "Blossom" (1519), by "Warrior" (902).

CLASS 34.—*Suffolk Fillies foaled in the Year* 1884.

273 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: FIRST PRIZE, 15*l*., for "Snowdrop" (1405), chestnut; bred by Mr. S. Wolton, Butley Abbey, Wickham Market; sire, "Chieftain"; dam, "Blyth II." (1073), by "Monarch" (1348)

272 ALFRED JAMES SMITH, Rendlesham, Woodbridge, Suffolk: SECOND PRIZE, 10*l*., for "Princess of May" (1142), chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "May Queen" (837), by "Prince Imperial" (1239).

274 THE DUKE OF HAMILTON AND BRANDON, K.T.: THIRD PRIZE, 5*l*., for "Vixen" (1849), chestnut; bred by the Duchess of Hamilton, The Pound, Great Glemham, Wickham Market; sire, "The Wanderer" (1463).

CLASS 35.—*Suffolk Fillies foaled in the Year* 1885.

275 SAMUEL WOLTON, Butley Abbey, Wickham Market, Suffolk: FIRST PRIZE, 15*l*., for "Virtue" (1767), chestnut; sire, "Chieftain" (1354); dam, "Foxhall Victory" (1080), by "Magnum Bonum" (1347): and
276 SECOND PRIZE, 10*l*., for 276, "Smart" (1763), chestnut; sire, "Chieftain" (1354); dam, "Blyth 2nd" (1073), by "Monarch" (1348); both bred by himself.

278 ALFRED J. SMITH, Rendlesham, Woodbridge: THIRD PRIZE, 5*l*., for "Miss Mag" (1760), chestnut; bred by himself; sire, "Field Marshal" (1106).

CLASS 36.—*Agricultural Fillies not qualified to compete as Shire, Clydesdale, or Suffolk, foaled in the Year* 1884.*

281 EDWARD CHARLTON, Shaw House, Stocksfield-on-Tyne: FIRST PRIZE, 15*l*., for "Lassie," bay; bred by himself; sire, "Merry Monarch" (538); dam, "Lady," by "The Chief" (857).

285 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: SECOND PRIZE, 10*l*, for "Princess Charlotte," bay; bred by himself; sire, "Gallant Scot"; dam, "Princess Royal," by "Prince of Wales."

282 R. N. SUTTON-NELTHORPE, Scawby Hall, Brigg, Lincolnshire: THIRD PRIZE, 5*l*., for his bay; breeder unknown.

283 JOHN CASTLEHOW TOPPIN, Musgrave Hall, Penrith, Cumberland: the *Reserve Number* and *Highly Commended* for "Baroness," brown; bred by Mr. Hudson, Hackthorpe Hall, Penrith; sire, "Baron Scott" (1936).

CLASS 37.—*Agricultural Fillies not qualified to compete as Shire, Clydesdale, or Suffolk, foaled in the Year* 1885.*

293 THE MARQUIS OF LONDONDERRY, Seaham Hall, Co. Durham: FIRST PRIZE, 15*l*., for "Myra," bay; bred by himself; sire, "Go Bang"; dam, "Merryton Maid," by "Prince of Wales."

289 EDWARD CHARLTON, Shaw House, Stocksfield-on-Tyne: SECOND PRIZE, 10*l.*, for his chestnut; bred by himself; sire, "Merry Monarch" (538); dam, "Vase," by "The Chief" (857).

290 LORD EGERTON OF TATTON, Tatton Park, Knutsford, Cheshire: THIRD PRIZE, 5*l.*, for "Marvel," bay; bred by himself; sire, "Waring's Wonder" (2688).

292 The MARQUIS OF LONDONDERRY, Seaham Hall: the *Reserve Number* and *Highly Commended* for "Judith," brown; bred by himself; sire, "Baron Douglas"; dam, "Jeannie," by "Newstead."

CLASS 38.—*Agricultural Fillies not qualified to compete as Shire, Clydesdale, or Suffolk, foaled in the Year* 1886.*

298 THE MARQUIS OF LONDONDERRY, Seaham Hall, Co. Durham: FIRST PRIZE, 15*l.*, for "Blanche," brown; bred by himself; sire, "Go Bang"; dam, "Bonny," by "Fashion-o'-the-Day."

295 EDWARD CHARLTON, Shaw House, Stocksfield-on-Tyne: SECOND PRIZE, 10*l.*, for his black; bred by himself; sire, "Merry Monarch" (538); dam, "Vase," by "The Chief" (857).

297 THE MARQUIS OF LONDONDERRY, Seaham Hall: THIRD PRIZE, 5*l.*, for "Dinorah," black; bred by himself; sire, "Castlereagh"; dam, "Damsel," by "Blantyre."

CLASS 39.—*Draught Mares of any breed foaled previously to the Year* 1884 (*not with Foal at foot*).*

303 DAVID RIDDELL, Blackhall, Paisley, Renfrewshire: FIRST PRIZE, 15*l.*, for "Bonny Jean," brown; was foaled in 1883; bred by Mr. T. Kerr, Whitehill, Sanquhar, Dumfriesshire; sire, "Prince of Wales"; dam, by "King of Kintyre."

304 WILLIAM R. TROTTER, South Acomb, Stocksfield-on-Tyne: SECOND PRIZE, 10*l.*, for "Gazelle," bay; was foaled in 1882; bred by Mr. J. Blyth, Leckie Bank, Auchtermuchty, N.B.; sire, "Young Baronet"; dam, "Brisk," by "Landseer."

302 THE MARQUIS OF LONDONDERRY, Seaham Hall, Co. Durham: THIRD PRIZE, 5*l.*, for "Winnie" (5550), bay; was foaled in 1882; bred by Mr. R. Hutchinson, Craigsland, Troon, Ayrshire; sire, "Lucky Getter"; dam, "Sally of Craigsland," by "Emperor."

300 THE EARL OF ELLESMERE, Worsley Hall, Manchester: the *Reserve Number* for "Black Depper," black; was foaled in 1880; bred by Mr. Peter Blundell, Ream Hills, Weeton, Kirkham, Lancashire; sire, "Sir Colin" (2022); dam, "Jewel," by "Sir Roger" (2026).

CLASS 40.—*Draught Geldings of any breed foaled in the years* 1883 *or* 1884.*

312 FREDERICK WILSON, Marden, Whitley, Northumberland: FIRST PRIZE, 15*l.*, for his bay; was foaled in 1884; breeder unknown; sire, "Royal Oak."

311 THE MARQUIS OF LONDONDERRY, Seaham Hall, Co. Durham: SECOND PRIZE, 10*l.*, for "Hector," chestnut; was foaled in 1884; bred by himself; sire, "The Viscount."

307 THOMAS THOMPSON, of Fairle, Stocksfield-on-Tyne, Northumberland: THIRD PRIZE, 5*l.*, for "Monarch," chestnut; was foaled in 1884; bred by himself; dam, by "Merry Monarch" (538).

313 FREDERICK WILSON, Marden: the *Reserve Number* for his bay; was foaled in 1883; breeder unknown; sire, "Prince Henry."

CLASS 41.—*Pairs of Draught Mares or Geldings of any age or breed.**

319 LORDS A. AND L. CECIL, Orchardmains, Innerleithen, Peeblesshire: FIRST PRIZE, 15*l.*, for "Edith Plantagenet," bay; was foaled in 1883; bred by Mr. Houston, Whiteleys, Dumbarton; sire, "Belted Knight" (1395); dam, "Lily of Whiteleys" (2352), by "Topsman" (886): and "Cornflower" (5290); was foaled in 1882; bred by Mr. Fredericks, Drumflower, Dunragit, Wigtownshire; sire, "Lord Lyon" (489); dam, "Young Mary" (519).

317 THE MARQUIS OF LONDONDERRY, Seaham Hall, Co. Durham: SECOND PRIZE, 10*l.*, for "Jeannie Darnley," brown mare; was foaled in 1883; bred by Mr. James Gourley, West Farm, Tollcross, Glasgow; sire, "Darnley"; dam, "Robina," by "Springfield Laddie": and "Star," brown mare; was foaled in 1881; bred by himself; sire, "What Care I"; dam, "Daisy,"
316 by "Time o' Day": and THIRD PRIZE, 5*l.*, for 316, "Lassie," black mare; was foaled in 1883; bred by himself; sire, "King of the Clans"; dam, "Laurel," by "Prince of Wales": and "Dennett," black mare; was foaled in 1883; bred by Mr. J. Young, Hamilton Farm, Cambuslang; sire, "St. Lawrence"; dam, by "Time o' Day."

CLASS 42.—*Hunter Mares or Geldings (weight-carriers) up to* 15 *stones, foaled previously to the Year* 1883.*

321 ROBERT CHAPMAN, Oaklands, Cheltenham, Gloucestershire: FIRST PRIZE, 30*l.*, and CHAMPION PRIZE, 21*l.*,† for "Tiptop," bay gelding; was foaled in 1880; breeder unknown; sire, "Highthorn."

335 ARTHUR BYASS, Norton Hall, Daventry, Northamptonshire: SECOND PRIZE, 15*l.*, for "Ring Row," grey gelding; was foaled in 1880; breeder unknown; sire, "The Victim."

331 JOHN HENRY STOKES, Great Bowden House, Market Harborough: THIRD PRIZE, 10*l.*, for "Marquis," bay gelding, aged; breeder unknown.

323 JOHN C. STRAKER, The Mazes, Hexham, Northumberland: the *Reserve Number* for "Lord Harry," bay gelding; was foaled in 1880; breeder unknown; sire, "Victor"; dam, by "Artillery."

CLASS 43.—*Hunter Mares or Geldings (light-weights) up to* 12 *stones, foaled previously to the Year* 1883.*

355 JOHN HENRY STOKES, Great Bowden House, Market Harborough: FIRST PRIZE, 30*l.*, for "Orange," chestnut gelding; was foaled in 1881; breeder unknown; sire, "Ouragan II."

338 JOHN RUTHERFORD, Summerhill, Annan, Dumfriesshire: SECOND PRIZE, 15*l.*, for "Shamrock," bay gelding; was foaled in 1876; bred by Mr. W. Spaight, Derry Castle, Killaloe, County Clare; sire, "Lord Ronald."

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† Given by the Sheriff of Newcastle (W. H. Stephenson, Esq.) for the best Mare or Gelding in Classes 42, 43, 44, and 45.

357 W. C. Bingham, Cowley Manor, Cheltenham, Gloucestershire: Third Prize, 10*l*., for "Pioneer," grey gelding; age and breeder unknown.

349 Alfred Hassall Straker, Stagshaw House, Corbridge-on-Tyne: the *Reserve Number* for "Red Earl," bay gelding, aged; breeder unknown; sire, "Birdcatcher."

Class 44.—*Hunter Geldings foaled in the Year* 1883.*

369 Andrew John Brown, North Elmsall Hall, Pontefract, Yorkshire: First Prize, 30*l*., for "Le Premier," chestnut; breeder unknown; sire, "Boreas."

370 James M. Mitchelson, The Hall, Pickering, Yorkshire: Second Prize, 15*l*., for "Randolph," bay; bred by Mr. Welford, Ugthorpe, Whitby, Yorkshire; sire, "Bass Rock."

371 James S. Darrell, West Ayton, York: Third Prize, 10*l*., for "Blair Athol," chestnut; bred by Mr. Patrick Shield, Dublin; sire, "Blair Drummond."

364 George C. Blayney, 32, Grainger Street, Newcastle-on-Tyne: the *Reserve Number* for "Moorcock," brown; breeder unknown; sire, "Bourkie"; dam, "Van Galon."

Class 45.—*Hunter Mares foaled in the Year* 1883.

377 Frederick Blenkin, Old Hall, Burstwick, Hull, Yorkshire: First Prize, 25*l*., for "Princess Beatrice," chestnut; bred by himself; sire, "Bay President"; dam, "Empress," by "Theobald."

375 Miss Helen Graham, Cavendish Mount, Stanwix, Carlisle: Second Prize, 15*l*., for "Sunbeam," chestnut; bred by Mr. G. J. Bell, The Nook, Brampton, Cumberland; sire, "Golden Horn."

376 William Henry Grainger, Fenton, Carlisle: Third Prize, 5*l*., for "Orange Girl," chestnut; bred by himself; sire, "Golden Horn"; dam, "Jean," by "Laughing-stock."

379 John Hawking, Ellinthorpe Hall, Boroughbridge, Yorkshire: the *Reserve Number* for "Duchess," chestnut; bred by himself; sire, "Syrian"; dam, by "Birdcatcher."

Class 46.—*Hunter Geldings foaled in the Year* 1884.*

395 Lord Middleton, Birdsall House, York: First Prize, 15*l*., for his bay; bred by himself; sire, "King Harold"; dam, "Beeswing," by "Morocco."

384 John Page Sowerby, Stokesley, Yorkshire: Second Prize, 10*l*., for "Spartan," bay; bred by Mr. Raine, Nunstainton, Sedgefield, Co. Durham; sire, "Omega"; dam, by "Amsterdam."

396 Andrew John Brown, North Elmsall Hall, Pontefract, Yorkshire: Third Prize, 5*l*., for his bay; breeder unknown; sire, "Massinessa"; dam, by "Old Victor."

398 Christopher Stephenson, Naworth, Brampton, Cumberland: the *Reserve Number* and *Highly Commended* for "Saxon," chestnut; bred by Mr. Joseph Todd, Moor End, Thursby, Cumberland; sire, "Golden Horn"; dam, by "Kingfisher."

CLASS 47.—*Hunter Fillies (likely to become weight-carriers) foaled in the Year* 1884.

402 WILLIAM ARMSTRONG, Moor Row, Wigton, Cumberland: FIRST PRIZE, 15*l.*, for "Jubilee Queen," chestnut; bred by Mr. G. Carr, Silloth, Cumberland; sire, "Gladstone"; dam, "Bessie," by "Laughing-stock."

404 ANDREW JOHN BROWN, North Elmsall Hall, Pontefract, Yorkshire: SECOND PRIZE, 10*l.*, for his bay; bred by Mr. Ryan, Bruree, Co. Limerick, Ireland; sire, "Old Victor"; dam, by "British Lion."

401 ROBERT WYSE, Auburn Hill, Malton, Yorkshire: the *Reserve Number* for "Bonny May," bay; bred by himself; sire, "Haphazard"; dam, by "Bass Rock."

CLASS 48.—*Hunter Geldings foaled in the Year* 1885.*

407 EDWARD BARTON, Warton Grange, Carnforth, Lancashire: FIRST PRIZE, 15*l.*, for "Pilgrim," brown; bred by himself; sire, "Carthusian"; dam, "Matilda," by "Voltigeur."

405 ROBERT JAMES MANN, Home Farm, Acton Burnell, Shropshire: SECOND PRIZE, 10*l.*, for "King Twala," brown; bred by Mr. Stirk, Grasing Nook, Bedale, Yorkshire; sire, "King Utopia"; dam, by "Morocco."

411 THOMAS CHARLES THOMPSON, Milton Hall, Milton, Cumberland: THIRD PRIZE, 5*l.*, for "Hildebrand," chestnut; bred by himself; sire, "Golden Horn"; dam, "Meggie," by "Potentate."

410 JOHN WILLIAM PAGE PAGE, Norton, Stockton-on-Tees, Co. Durham: the *Reserve Number* for "Hawthorn," chestnut; bred by himself; sire, "Highthorn"; dam, by "Gamester."

CLASS 49.—*Hunter Fillies (likely to become weight-carriers) foaled in the Year* 1885.

424 ROBERT JAMES MANN, Home Farm, Acton Burnell, Shropshire: FIRST PRIZE, 15*l.*, for "Happiness," chestnut; bred by Mr. G. N. Farwell, Walkerfield, Staindrop, Darlington, Co. Durham; sire, "Castlereagh."

432 T. TOMLINSON, Bradley, Ashbourne, Derbyshire: SECOND PRIZE, 10*l.*, for "Hilarity," bay; breeder unknown; sire, "Omegar"; dam, by "Laughing-stock."

423 ALFRED EDWARD PEASE, Pinchinthorpe House, Guisborough, Yorkshire: THIRD PRIZE, 5*l.*, for "Caress," chestnut; bred by himself; sire, "Syrian."

433 EDWIN H. BANKS, Highmoor, Wigton, Cumberland: the *Reserve Number* for "The Heiress," brown; bred by Mr. J. S. Mark, Wigton; sire, "Moss Hawk"; dam, by "Laughing-stock."

CLASS 50.—*Hunter Geldings or Fillies foaled in the Year* 1886*.

439 CHARLES HENRY JOHNSON, Cleasby Hall, Darlington, Co. Durham: FIRST PRIZE, 15*l.*, for "Jubilee," chestnut gelding; bred by himself; sire, "Mr. Winkle."

440 JOHN THOMAS ROBINSON, Leckby Palace, Asenby, Thirsk, Yorkshire: SECOND PRIZE, 10*l.*, for "Gone-away," brown gelding; bred by himself; sire, "Sedan"; dam, "Mrs. Whip," by "Baron Cavendish."

434 JOSEPH ALEXANDER, South Park, Hexham, Northumberland: THIRD PRIZE, 5*l.*, for "Tickey," chestnut gelding; bred by Mr. N. Maugher, Newbrough Lodge, Fourstones, Northumberland; dam, "Ida," by "Horizon."

437 FARQUHAR M. LAING, Farnley Grange, Corbridge-on-Tyne: the *Reserve Number* for "Leander," chestnut gelding; bred by himself; sire, "Golden Horn"; dam, "Platina."

CLASS 51.—*Coaching or Cleveland Geldings or Fillies foaled in the Year* 1885.*

446 GEORGE SCOBY, Beadlam Grange, Nawton, Yorkshire: FIRST PRIZE, 15*l.*, for "Hannah," bay filly; bred by himself; sire, "Salesman"; dam, "Sinington Lass," by "Candidate."

454 JOHN WHITE, The Grange, Appleton Roebuck, Bolton Percy, Yorkshire: SECOND PRIZE, 10*l.*, for "Lady Annie," bay filly; bred by himself; sire, "Newland" (606); dam, "Jenny," by "Progress."

451 SAMUEL BAKER, Wilton, Pickering, Yorkshire: THIRD PRIZE, 5*l.*, for "Royal George," brown gelding; bred by the late Mr. Coverdale, Sneaton, Whitby, Yorkshire; sire, "King George."

455 JOHN WILSON, Crossrigg, Penrith, Cumberland: the *Reserve Number* and *Highly Commended* for "Monarch," brown gelding; breeder unknown; sire, "Rhapsodist."

CLASS 52.—*Hackney Mares or Geldings (weight-carriers) above* 14 *hands and not exceeding* 15 *hands* 2 *inches, and up to not less than* 15 *stones, foaled previously to the Year* 1884.*

459 JOHN ROBINSON, Cleavland House, Coltman Street, Hull, Yorkshire: FIRST PRIZE, 20*l.*, for "Princess," chestnut mare; was foaled in 1880; bred by Mr. A. Fenson, Hedon, Hull; sire, "Lord Derby 2nd"; dam, by "Tom Thumb."

458 WILLIAM R. TROTTER, South Acomb, Stocksfield-on-Tyne: the *Reserve Number* for "Constance," brown mare; was foaled in 1882; bred by Mr. John Rowell, Bury, Huntingdon; sire, "D'Oyley's Confidence"; dam, "Brown Bess," by "Rifleman."

CLASS 53.—*Hackney Mares or Geldings (light-weights), above* 14 *hands and not exceeding* 15 *hands* 2 *inches, up to not less than* 12 *stones, foaled previously to the Year* 1884.*

468 JOHN ROBINSON, Cleavland House, Coltman Street, Hull: FIRST PRIZE, 20*l.*, for "Ethel," bay mare; was foaled in 1882; breeder unknown.

464 JOHN DUNNE, Moorhouse Hall, Warwick, Carlisle: SECOND PRIZE, 10*l.*, for "Carmarthen," red roan mare; was foaled in 1882; bred by Miss Morgan, Pentrefynis, Bronnyd, Carmarthen; sire, "Cardigan Comet 2nd."

462 ANTHONY DUNN, East Houses, Dissington, Dalton, Northumberland: THIRD PRIZE, 5*l.*, for "Lady Rose," brown mare; was foaled in 1883; bred by himself; sire, "Fireaway Charlie"; dam, by "Lammas-day."

466 HARRY GORDON-SMITH, Bankfield, Ulverston, Lancashire: the *Reserve Number* for "Maggie," roan mare; was foaled in 1877; bred by Mr. James Robinson, Ulverston; sire, "Sir George"; dam, "Bess," by "Mountain Hero."

CLASS 54.—*Pony Mares or Geldings above 13 hands, and not exceeding 14 hands.**

476 WILLIAM POPE, Cannon House, Downham Market, Norfolk: FIRST PRIZE, 15*l.*, for "Magpie" (228), black and white mare; was foaled in 1878; bred by Mr. E. Cooke, Litcham, Norfolk; sire, "Confidence"; dam, by "Premier."

475 RICHARD JACKSON, Wetheral Abbey, Carlisle: SECOND PRIZE, 10*l.*, for "Rowena," brown mare; was foaled in 1880; bred by Mr. George Spraggon, Nafferton, Stocksfield-on-Tyne; sire, "Young Dutchman."

470 JOHN JAMES SPEDDING, Greta Bank, Keswick, Cumberland: THIRD PRIZE, 5*l.*, for "Mac George," grey gelding; was foaled in 1878; bred by himself; sire, "Sir George"; dam, "Fanny."

474 WILLIAM GREGORY, 59 and 60, Newgate Street, Bishop Auckland, Co. Durham: the *Reserve Number* for "Garibaldi," bay gelding; was foaled in 1882; bred by Mr. R. Blackett, Woodlands, Hamsterley, Co. Durham; sire, "Fashion of the Day."

CLASS 55.—*Pony Mares or Geldings 12 hands, and not exceeding 13 hands.**

480 ARTHUR WILLIAM FOX, Grove House, Harrogate, Yorkshire: FIRST PRIZE, 10*l.*, for "Betty," brown mare; was foaled in 1879; breeder unknown.

485 WILLIAM M. ANGUS, 1, Fenham Terrace, Newcastle-on-Tyne: SECOND PRIZE, 5*l.*, for "Whitesocks," black gelding; was foaled in 1879; breeder unknown.

482 MRS. MACKIE, Auchencairn, Castle Douglas, N.B.: the *Reserve Number* and *Highly Commended* for "Sir Gibbir," brown gelding; was foaled in 1881; bred by Mr. Wakefield, Kendal, Westmoreland; sire, "Sir George" (778).

CLASS 56.—*Pony Mares or Geldings not exceeding 12 hands.**

489 RICHARD CLAYTON, Wylam Hall, Wylam-on-Tyne: FIRST PRIZE, 10*l.*, for "Melton," brown gelding; was foaled about 1879; breeder unknown.

488 FARQUHAR M. LAING, Farnley Grange, Corbridge-on-Tyne: SECOND PRIZE, 5*l.*, for "Sunbeam," chestnut gelding; age unknown; bred by the Marquis of Londonderry, Seaham Hall, Seaham Harbour.

490 MISS ISABEL ROBINSON, Cleavland House, Coltman Street, Hull: the *Reserve Number* and *Highly Commended* for "Royalty," brown gelding; was foaled in 1880; breeder unknown.

CLASS 57.—*Four Ponies, suitable for Pit purposes, not exceeding 10 hands 2 inches.**

493 THE MARQUIS OF LONDONDERRY, Seaham Hall, Seaham Harbour FIRST PRIZE, 10*l.*; were foaled in 1883; bred by himself.

492 THE HARTON COAL COMPANY, LD., Harton Colliery, South Shields, Co. Durham: SECOND PRIZE, 5*l.*; ages and breeders unknown.

CATTLE.

Class 58.—*Shorthorn Bulls, calved in either* 1882 *or* 1883.

497 William Handley, Green Head, Milnthorpe, Westmoreland: First Prize, 20*l.*, for "Royal Ingram" (50,374), red and white; was calved January 6th, 1883; bred by himself; sire, "Sir Arthur Ingram" (32,490); dam, "Harmony," by "Sir Arthur Windsor" (35,541); g. d., "Hannah," by "Prince Arthur" (29,597); gr. g. d., "Young White Ammons," by "Sir Walter Trevelyan" (25,179); gr. g. g. d., by "General Garibaldi" (21,813).

500 John Vickers, Catchburn, Morpeth, Northumberland: Second Prize, 10*l.*, for "Veteran" (52,288), roan; was calved September 26th, 1882; bred by Mr. C. Cradock, Hartforth, Richmond, Yorkshire; sire, "Lord Roseberry" (45,152); dam, "Velvet," by "Pilgrim" (35,036); g. d., "Venice," by "Wanderer" (32,790); gr. g. d., "Valencia," by "Valasco" (15,443); gr. g. g. d., "Lady Celia," by "Rifleman" (15,163).

496 William Handley, Milnthorpe: Third Prize, 5*l.*, for "Reformer" (53,521), red and little white; was calved March 13th, 1883; bred by Mr. W. Duthie, Collynie Tarves, Aberdeenshire; sire, "Earl of March" (33,807); dam, "Rapid Josephine," by "Rapid Foggathorpe" (43,867); g. d., "Josephine 2nd," by "Heir of Englishman" (34,128); gr. g. d., "Josephine," by "Prince Alfred" (22,567); gr. g. g. d., by "Guy Fawkes" (12,981).

498 Henry Williams, Moor Park, Harrogate, Yorkshire: the *Reserve Number* and *Commended* for "Prince of Halnaby" (53,464), roan; was calved October 24th, 1882; bred by Mr. W. T. Talbot-Crosbie, Ardfert Abbey, Ireland; sire, "King David" (43,417); dam, "Princess of Halnaby," by "Royal Halnaby" (39,041); g. d., "Princess Charlotte," by "Foreign Prince" (36,656); gr. g. d., "Brendina," by Regal Booth" (27,262); gr. g. g. d., "Royal Brenda," by "Royal Sovereign" (22,802).

Class 59.—*Shorthorn Bulls, calved in the Year* 1884.

502 John Garne, Great Rissington, S.O., Gloucestershire: First Prize, 20*l.*, for "Baronet," roan; was calved February 18th; bred by Mr. F. P. Bulley, Marston Hill, Fairford, Gloucestershire; sire, "Sir John Carew 2nd" (47,107); dam, "Venus 8th," by "Duke of Hazlecote 55th" (37,946); g. d., "Venus 7th," by "Chorister" (36,362); gr. g. d., "Venus 6th," by "Lord Stanley" (22,217); gr. g. g. d, "Venus 5th," by "Sarsden Clipper" (20,787).

504 James McWilliam, Stoneytown, Keith, N.B.: Second Prize, 10*l.*, for "Royal Victor" (52,068), roan; was calved May 16th; bred by the Duke of Northumberland, Alnwick Park, Northumberland; sire, "Eastern Emperor" (44,763); dam, "Royal Alberta," by "Prince Albert Victor" (40,479); g. d., "Rosebud 12th," by "Hotspur" (28,876); gr. g. d., "Rosebud 11th," by "Brigand" (28,080); gr. g. g. d., "Rosebud 7th," by "Snowflake" (18,808).

505 Louis Ponsonby, Terrick Farm, Tring, Herts: Third Prize, 5*l.*, for "Prince Arthur" (51,869), white; was calved December 1st; by Messrs. Taylor, Hall Garth, Kirkby Stephen; sire, "Lord Ormskirk Gwynne" (41,905); dam, "Lady of Nunwick 2nd," by "Hubback Junior" (31,395); g. d., "Lady of Nunwick," by "Lord of Nunwick" (26,702); gr. g. d., "Cherry Blossom," by "Lieutenant" (18,198); gr. g. g. d., "Dahlia," by "Duke" (14,421).

503 ROBERT HARRISON, Underpark, Lealhom, Grosmont, Yorkshire: the *Reserve Number* for "British General" (50,916), roan; was calved March 10th; bred by Mr. E. Tindall, Knapton Hall, Rillington, Yorkshire; sire, "Blairmore" (49,156); dam, "Derwent Queen 2nd," by "Sampiero" (35,466); g. d., "White Thorn," by "Cecil" (25,725); gr. g. d., "Miss Wiley," by "Cavendish" (15,745); gr. g. g. d., "Miss Spearman," by "Sir Charles" (16,949).

CLASS 60.—*Shorthorn Bulls, calved in the Year* 1885.

514 WILLIAM HANDLEY, Green Head, Milnthorpe: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 25*l.*,† for "Ingram's Fame" (53,026), red and white; was calved June 17th; bred by himself; sire, "Royal Ingram" (50,374); dam, "Anemone 2nd," by "Sir Arthur Ingram" (32,490); g. d., "Anemone," by "Sir Arthur Windsor" (35,541); gr. g. d., "Ammonia," by "Prince Arthur" (29,597); gr. g. g. d., "Roan Ammons," by "Sir Walter Trevelyan" (25,179).

517 JOHN VICKERS, Catchburn, Morpeth, Northumberland: SECOND PRIZE, 10*l.*, for "Chief Justice," red; was calved December 11th; bred by himself; sire, "Ingram's Chief" (51,423); dam, "Purity," by "Duke of Howl John" (33,674); g. d., "Lady Wild Eyes," by "Did you Ever" (30,874); gr. g. d., "Lady Meadows," by "Knight of Richard Cœur-de-Lion" (20,080); gr. g. g. d., "White Lady," by "Baron Stapleton" (15,627).

510 ALEXANDER LAUDERDALE DUNCAN, Knossington Grange, Oakham: THIRD PRIZE, 5*l.*, for "Melton," roan; was calved January 23rd; bred by the late Mr. E. Pease, The Crundalls, Bewdley, Worcestershire; sire, "Earl of Aylesby 4th" (46,291); dam, "Park Nellie 3rd," by "Foster Brother" (36,661); g. d., "Nellie," by "Chieftain" (20,942); gr. g. d., "Helen," by "Field Marshal" (16,044); gr. g. g. d., "Bessy," by "Apollo" (9898).

512 JAMES ADAM GORDON, Arabella, Nigg Station, Ross-shire: the *Reserve Number* and *Highly Commended* for "Mac Beath," red and white; was calved April 30th; bred by himself; sire, "Macgregor" (50,001); dam, "Bessie Belle," by "Rosario" (35,315); g. d., "Betty Butterfly," by "Butterfly Charlie" (28,111); gr. g. d., "Betty," by Mars" (29,307); gr. g. g. d., "Lady Love," by "Gold Nugget" (16,176).

CLASS 61.—*Shorthorn Bulls, calved in the Year* 1886.

534 WILLIAM HANDLEY, Green Head, Milnthorpe: FIRST PRIZE, 20*l.*, for "Golden Hind," roan; was calved February 3rd; bred by himself; sire, "Self Esteem 2nd" (48,675); dam, "Princess Flora," by "Alfred the Great" (36,121); g. d., "Earl's Flora," by "Earl of Eglinton" (23,832); gr. g. d., by "Marquis of Cobham" (22,299); gr. g. g. d., by "Alfred FitzClarence" (19,215).

537 ANTHONY METCALFE-GIBSON, Coldbeck, Ravenstonedale, Kirkby Stephen, Westmoreland: SECOND PRIZE, 10*l.*, for "Royal Dalesman," roan; was calved August 14th; bred by himself; sire, "Royal Ingram" (50,374); dam, "Weal Faith," by "Royal Brilliant" (45,508); g. d., "Weal Charity," by King Brian" (34,308); gr. g. d., "Weal Hope," by "Royal Prince" (27,384); gr. g. g. d., "Weal Royal," by "Booth Royal" (15,673).

† Given by the Shorthorn Society for the best male Shorthorn.

524 THE DUKE OF NORTHUMBERLAND, Alnwick Castle, Northumberland: THIRD PRIZE, 5*l.*, for "Hopeful," red and white; was calved May 19th; bred by himself; sire, "Hopewell" (51,403); dam, "Blushing Maid," by "Mayor of Windsor" (31,897); g. d., "Bridesmaid," by "Ace of Trumps" (30,355); gr. g. d., "Dewdrop," by "President" (20,510); gr. g. g. d., "Maid of Aln," by "Melsonby" (18,380).

536 WILLIAM HANDLEY, Milnthorpe: the *Reserve Number* and *Highly Commended* for "Self Conceit," red and little white; was calved February 26th; bred by himself; sire, "Self Esteem 2nd" (48,675); dam, "Derwent Queen," by "Baron Stackhouse" (30,488); g. d., "Derwent Lady 2nd," by Vice Roi" (30,214); gr. g. d., "Derwent Lady," by "The Premier" (27,640); gr. g. g. d., by "Baron Killerby" (23,364).

CLASS 62.—*Shorthorn Cows, in-milk or in-calf, calved previously tc or in the Year* 1883.

546 TEASDALE HILTON HUTCHINSON, Manor House, Catterick, Yorkshire: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 25*l.*,† for "Lady Pamela," roan; was calved March 17th, 1881; in-milk; calved March 21st, 1887, and in-calf; sire, "British Knight" (33,220); dam, "Lady Pateley," by "Vehement" (33,853); g. d., "Lady Nidderdale," by "Merry Monarch" (22,349); gr. g. d., "Lady Fly," by "Champion" (23,520); gr. g. g. d., "Purity," by "Perfection" (27,049): and SECOND PRIZE, 10*l.*,
545 for 545, "Glad Tidings," roan; was calved December 24th, 1880; in-milk; calved September 29th, 1886, and in-calf; sire, "Master of Arts" (34,816); dam, "Gratification," by "M. C." (31,896); g. d., "Gerty 3rd," by "Knight of the Shire" (26,552); gr. g. d., "Gerty," by "Vain Hope" (23,102); gr. g. g. d., "Garland," by "Grand Master" (24,078); both bred by himself.

547 THE DUKE OF PORTLAND, Clipstone Park Farm, Mansfield, Notts: the *Reserve Number* and *Highly Commended* for "Lady Ottoline," roan; was calved May 16th, 1883; in-milk; calved January 27th, 1887, and in-calf; bred by himself; sire, "Paragon" (40,440); dam, "Lady Siddington," by "Baron Turncroft Siddington" (37,823); g. d., "Elvira 2nd," by "Major Thorndale" (31,807); gr. g. d., "Elvira," by "MacTurk" (14,872); gr. g. g. d., "Juno," by "Sheldon" (8557).

CLASS 63.—*Shorthorn Cows or Heifers, in-milk or in-calf, calved in the Year* 1884.

556 ROBERT THOMPSON, Inglewood, Penrith, Cumberland: FIRST PRIZE, 20*l.*, for "Molly Millicent," roan; was calved June 11th; in-milk; calved February 14th, 1887, and in-calf; bred by himself; sire, "Beau Benedict" (42,769); dam, "Fair Millicent 2nd," by "Brilliant Butterfly" (36,270); g. d., "Fair Millicent," by "Grand Duke of Fawsley 3rd" (31,286); gr. g. d., "Moss Rose 4th," by "Royal Gwynne" (22,784); gr. g. g. d., "Moss Rose," by "Lord of Brawith" (10,465).

561 WILLIAM HOSKEN AND SON, Loggans Mill, Hayle, Cornwall: SECOND PRIZE, 10*l.*, for "Alexandria 9th," roan; was calved January 2nd; in-milk; calved December 5th, 1886; bred by themselves; sire, "Grand Duke of Oxford 5th" (43,318); dam, "Alexandria 5th," by "Prince of Oxford" (42,212); g. d., "Alexandria," by "Second Earl of Oxford"

† Given by the Shorthorn Society for the best female Shorthorn.

(23,844); gr. g. d., "Maid of Athens," by "Sir Richard" (15,298); gr. g. g. d., "Miss Bloomer," by "Siddington Duke" (15,263).

554 John Garne, Great Rissington, S.O., Gloucestershire: Third Prize, 5*l.*, for "Petted Pansy," white; was calved March 19th; in-calf; bred by himself; sire, "Prince Frogmore Seal" (48,488); dam, "Scotland's Pansy," by "Scotland's Glory" (40,679); g. d., "Aldsworth Pansy," by "Prince Alfred" (35,083); gr. g. d., "Pansy 3rd," by "Noble Duke" (24,661); gr. g. g. d., "Pansy 2nd," by "Cambridge Prince Royal" (19,380).

549 The Rev. Robert Bruce Kennard, Marnhull Rectory, Blandford, Dorset: the *Reserve Number* and *Highly Commended* for "Queen of the Isles," red and little white; was calved April 14th; in-milk; calved January 31st, 1887; bred by himself; sire, "Montrose" (45,261); dam, "Queen of the Glebe," by "Lord Fitzclarence 24th" (40,163); g. d., "Queen Victoria," by "Marquis of Blandford 4th" (38,712); gr. g. d., "Queen Mary," by "Grand Duke of Oxford" (28,763); gr. g. g. d., "Queen Anne," by "Lord Stanley 2nd" (26,745).

Class 64.—*Shorthorn Heifers, calved in the Year* 1885.

570 David Pugh, M.P., Manoravon, Llandilo, Carmarthenshire: First Prize, 20*l.*, for "Zoe 5th," roan; was calved June 18th; in-calf; bred by himself; sire, "Sir Charles" (44,020); dam, "White Zoe," by "Falmouth" (38,268); g. d., "Zoe," by "Marquis 1st" (34,774); gr. g. d., "Czarina 10th," by "Duke of Albemarle" (28,355); gr. g. g. d., "Czarina 9th," by "Falconer" (23,907).

566 Robert Thompson, Inglewood, Penrith, Cumberland: Second Prize, 10*l.*, for "Inglewood Gem," roan; was calved September 14th; bred by himself; sire, "Royal Baron" (50,354); dam, "Inglewood Belle," by "Beau Benedict" (42,767); g. d., "Inglewood Pet," by "Brilliant Butterfly" (36,270); gr. g. d., "Love Token," by "Grand Duke of Fawsley 3rd" (31,286); gr. g. g. d., "Farewell," by "Royal Westmoreland" (35,416).

572 Thomas Eades Walker, Studley Castle, Warwickshire: Third Prize, 5*l.*, for "Princess Royal 6th," roan; was calved August 2nd; bred by himself; sire, "Fernandez 2nd" (49,582); dam, "Princess Royal 5th," by "Bromsgrove" (44,480); g. d., "Princess Royal 2nd," by "Grand Duke of Studley 2nd" (39,954); gr. g. d., "Miss Mann 2nd," by "Lord Royal" (34,662); gr. g. g. d., "Miss Mann," by "Bull's Bay" (23,490).

563 The Duke of Northumberland, Alnwick Castle, Northumberland: the *Reserve Number* and *Highly Commended* for "Rose of Borrowdale," red and white; was calved July 30th; bred by himself; sire, "Royal Mowbray" (42,330); dam, "Rose of Glendale," by "Sir Raymond" (40,716); g. d., "Rose of Allandale," by "Fitz-Roland" (33,936); gr. g. d., "Rose of Tyne," by "Duke of Tyne" (33,744); gr. g. g. d., "Marion," by "Vanguard" (23,115).

Class 65.—*Shorthorn Heifers, calved in the Year* 1886.

587 Price Allen Evans, Uffington, Shrewsbury: First Prize, 20*l.*, for "Lady Oxford Waterloo 5th," roan; was calved April 17th; bred by himself; sire, "Viscount Oxford of Elmhurst" (48,892); dam, "Waterloo Belle," by "Wild Duke 3rd" (42,611); g. d., "Grand Waterloo 2nd," by "Oxford Beau 4th" (34,964); gr. g. d., "Grand Waterloo," by "Grand Duke 13th" (21,850); gr. g. g. d., "Waterloo 22nd," by "Kildonan" (20,051).

583 John Walter, Bearwood, Wokingham, Berkshire: Second Prize, 10*l.*, for "Honeybeam 5th," roan; was calved January 4th; bred by H.R.H. The Prince of Wales, K.G., Sandringham, Norfolk; sire, "Geometry" (47,946); dam, "Honey 55th," by "Duke of Rosedale 2nd" (33,722); g. d., "Honey 32nd," by "Duke of Clarence 3rd" (23,727); gr. g. d., "Honey 17th," by "Grand Duke of Wetherby" (17,997); gr. g. g. d., "Helen," by "Oregon" (8371).

588 The Marquis of Exeter, Burghley House, Stamford: Third Prize, 5*l.*, for "Charity," roan; was calved February 28th; bred by himself; sire, "Captain Innocence 2nd" (49,225); dam, "Gannet," by "Telemachus 6th" (35,725); g. d., "Sea-Gull," by "Nestor" (24,648); gr. g. d., "Petrel," by "Duke of Thorndale 4th" (17,750); gr. g. g. d., "Sandpiper," by "Briar" (15,376).

581 Sir John Swinburne, Bart., M.P., Capheaton, Newcastle-upon-Tyne: the *Reserve Number* and *Highly Commended* for "Waterloo Maid 7th," red; was calved January 22nd; bred by himself; sire, "Duke of Oxford 69th" (49,475); dam, "Waterloo Maid 3rd," by "Duke of Oxford 48th" (41,415); g. d., "Waterloo 32nd," by "Grand Duke of Lightburne 2nd" (26,291); gr. g. d., "Waterloo 22nd," by "Speculator" (13,775); gr. g. g. d., "Waterloo 18th," by "Bosquet" (14,183).

Class 66.—*Hereford Bulls, calved in either* 1882, 1883, *or* 1884.

604 Henry William Taylor, Showle Court, Ledbury, Herefordshire: First Prize, 20*l.*, for "Maidstone" (8875); was calved April 20th, 1883; bred by himself; sire, "Franklin" (6961); dam, "Duchess 4th," by "Tredegar" (5077); g. d., "Duchess," by "Twin" (2284); gr. g. d., "Duchess," by "Alma" (1144); gr. g. g. d., "Victoria," by "Prince Albert" (686).

606 Richard Edwards, The Sheriffs, Lyonshall, Kington, Herefordshire: Second Prize, 10*l.*, for "Magnet" (8873); was calved July 7th, 1883; bred by himself; sire, "Marquis" (6057); dam, "Broken Horn 4th," by "Commander" (4452); g. d., "Old Broken Horn," by "Governor" (3137); gr. g. d., "Peach," by "Pollox" (2163); gr. g. g. d., "Peach," by "Pilot" (1036).

601 The Earl of Coventry, Croome Court, Severn Stoke, Worcestershire: Third Prize, 5*l.*, for "Rare Sovereign" (10,499); was calved February 19th, 1884; bred by himself; sire, "Good Boy" (7668); dam, "Rare Jewel," by "Merry Monarch" (5466); g. d., "Rarity 14th," by "Archduke" (4312); gr. g. d., "Rarity 3rd," by "Silver Prince" (5583); gr. g. g. d., "Rarity," by "Conqueror" (1929).

603 William Thompson Crawshay, Cyfarthfa Castle, Merthyr Tydfil, Glamorganshire: the *Reserve Number* for "Stockton Prince" (10,688); was calved April 8th, 1884; bred by the late Mr. T. J. Carwardine, Stocktonbury, Leominster, Herefordshire; sire, "Lord Wilton" (4740); dam, "Ruth," by "Rodney" (4907); g. d., "Bella," by "De Cote" (3060); gr. g. d., "Charity," by "Heart of Oak" (2035); gr. g. g. d., "Luna," by "Counsellor" (1939).

Class 67.—*Hereford Bulls, calved in the Year* 1885.

614 William Tudge, Leinthall, Ludlow: First Prize, 20*l.*, for "Regent" (11,589); was calved January 9th; bred by himself; sire, "Regal" (9121); dam, "Rhea," by "Romulus" (5542); g. d., "Rhoda," by "Sir

Roger" (4133); gr. g. d., "Elvira," by "Orleans" (2661); gr. g. g. d., "Edith," by "Sergeant" (2746).

608 ALLEN EDWARDS HUGHES, Wintercott, Leominster, Herefordshire: SECOND PRIZE, 10*l.*, for "Pirate" (11,531); was calved March 28th; bred by himself; sire, "Garfield 2nd" (7648); dam, "Purity," by "Royalist" (4921); g. d., "Polly," by "Blucher" (2964): gr. g. d., "Pinky 3rd," by "Young Grove" (2888); gr. g. g. d., "Pinky," by "Rambler" (1046).

609 THE EARL OF COVENTRY, Croome Court, Severn Stoke: THIRD PRIZE 5*l.*, for "Rondeau": was calved February 25th; sire, "Minstrel" (8915); dam, "Rhodia 4th," by "Spartan" (5009); g. d., "Rhodia," by "Subaltern" (2794); gr. g. d., "Norma," by "Bolingbroke" (1883); gr. g. g. d., "Carissima," by "Felix" (953): and the *Reserve Number*
610 and *Commended* for 610, "Textuary"; was calved January 28th; sire, "Good Boy" (7668); dam, "Tulip 8th," by "Monkton Lad" (5646), g. d., "Tulip 5th," by "Triumph 2nd" (3553); gr. g. d., "Tulip 3rd," by "Sir Frank" (2762); gr. g. g. d., "Tulip 2nd," by "France" (1993); both bred by himself.

CLASS 68.—*Hereford Bulls, calved in the Year* 1886.

624 ARTHUR PHILIP TURNER, The Leen, Pembridge, Herefordshire: FIRST PRIZE, 20*l.*, for "Tarquin"; was calved February 23rd; bred by himself; sire, "Sir Edward" (10,631); dam, "Kathleen," by "The Grove 3rd" (5051); g. d., "Helena," by "Corsair" (5271); gr. g. d., "Elfrida," by "Prince Arthur" (3345); gr. g. g. d., "Ella," by "Bachelor" (2941).

627 JOHN TUDGE, Alton Court, Dilwyn, R. S. O., Herefordshire: SECOND PRIZE, 10*l.*, for "Alton"; was calved August 8th; bred by himself; sire, "Leinthall" (8801); dam, "Coral," by "Maréchal Niel" (4760); g. d., "Constance," by "Magnum Bonum" (2097); gr. g. d., "Countess," by "Young Sir David" (1818); gr. g. g. d., "Rose," by "Young Walford" (1820).

618 THE EARL OF COVENTRY, Croome Court, Severn Stoke: THIRD PRIZE, 5*l.*, for "Golden Miner"; was calved March 22nd; bred by himself; sire, "Californian" (8355); dam, "Golden Dream," by "Fisherman" (5913); g. d., "Golden Treasure," by "Maréchal Niel" (4760); gr. g. d., "Giantess," by "Sir Roger" (4133); gr. g. g. d., "Haidee," by "Battenhall" (2406).

625 HENRY WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: the *Reserve Number* and *Commended* for "Sarchedon"; was calved August 27th; bred by himself; sire, "Maidstone" (8875); dam, "Fairy," by "Thoughtful" (5063); g. d., "Hazel," by "Tom Brown" (2828); gr. g. d., "Hazel," by "Holmer" (2043); gr. g. g. d., "Hazel," by "Showle" (1384).

CLASS 69.—*Hereford Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

633 HENRY WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: FIRST PRIZE, 20*l.*, for "Gem"; was calved October 2nd, 1884; in-calf; bred by himself; sire, "Franklin" (6961); dam, "Modesty," by "Tredegar" (5077); g. d., "Lovely," by "Tenant Farmer" (2806); gr. g. d., "Browny," by "Twin" (2284).

639 Sir Joseph Layton Elmes Spearman, Bart., of Llausaunor Court, Cowbridge, Glamorganshire: Second Prize, 10*l*., for "Myrtle 6th"; was calved June 2nd, 1880; in-calf; bred by Mr. S. Goode, Irvingtonbury, Leominster, Herefordshire; sire, "Embassador" (4551); dam, "Myrtle 4th," by "Blucher" (2964); g. d., "Myrtle 3rd," by "Albert" (2921); gr. g. d., "Myrtle 2nd," by "Pompey" (2683); gr. g. g. d., "Myrtle 1st," by "Demetrius" (2494).

630 Allen Edwards Hughes, Wintercott, Leominster, Herefordshire: Third Prize, 5*l*., for "Sunflower"; was calved April 23rd, 1882; in-milk; calved November 28th, 1886; bred by himself; sire, "Commander" (4452); dam, "Spangle 4th," by "Royalist" (4921); g. d., "Sonnet," by "Leominster 3rd" (3211); gr. g. d., "Silk," by "Comet" (2469); gr. g. g. d., "Silva," by "Adforton" (1839).

631 The Earl of Coventry, Croome Court, Severn Stoke: the *Reserve Number* and *Highly Commended* for "Camera"; was calved February 2nd, 1883; in-milk; calved January 6th, 1887; bred by himself; sire, "Bonaparte" (6316); dam, "Camomile 2nd," by "Fisherman" (5913); g. d., "Camomile," by "Governor 3rd" (4619); gr. g. d., "Miss Chieftain," by "Silver Chief" (4952); gr. g. g. d., by "Macaroni" (2627).

Class 70.—*Hereford Heifers, calved in the Year* 1885.

646 Rees Keene, Pencraig, Caerleon, Monmouthshire: First Prize, 20*l*., for "Bangle"; was calved January 7th; bred by himself; sire, "Bangham" (6793); dam, "Fancy 6th," by "Tredegar" (4210); g. d., "Fancy" by "Sir Colin" (1727); gr. g. d., "Tidy," by "General Wyndham" (1590); gr. g. g. d., "Spot," by "Prince Albert" (2168).

643 William Thompson Crawshay, Cyfarthfa Castle, Merthyr Tydfil, Glamorganshire: Second Prize, 10*l*., for "Cyfarthfa Violet"; was calved August 19th; bred by himself; sire, "Westbury" (8158); dam, "Downton Violet," by "Downton Boy" (5877); g. d., "Violet," by "Grandee" (5344); gr. g. d., "Stockwell," by "Stockwell" (2792); gr. g. g. d., "Violet 2nd," by "Trooper" (2838).

642 Allen Edwards Hughes, Wintercott, Leominster: Third Prize, 5*l*., for "Blossom"; was calved January 14th; bred by himself; sire, "Garfield 2nd" (7648); dam, "Bonny Lass," by "Commander" (4452); g. d., "Bonny 3rd," by "Royalist" (4921); gr. g. d., "Barmaid 3rd," by "Leominster 3rd" (3211); gr. g. g. d., "Barmaid," by "Royal George" (2197).

640 Ralph Palmer, Lodge Farm, Nazing, Waltham Cross, Essex: the *Reserve Number* and *Highly Commended* for "Lightfoot"; was calved June 23rd; bred by himself; sire, "Rose Stock" (6651); dam, "Lilian V. 13," by "Rodney" (4907); g. d., "Lilac V. 12," by "De Cote" (3060); gr. g. d., "Fanny," by "Heart of Oak" (2035); gr. g. g. d., "Alethea," by "Sir John 2nd" (3455).

Class 71.—*Hereford Heifers, calved in the Year* 1886.

653 John Hungerford Arkwright, Hampton Court, Leominster: First Prize, 20*l*., for "Ivington Lass 24th"; was calved January 1st; bred by himself; sire, "Rose Cross" (7237); dam, "Ivington Lass 5th," by "Concord" (4458); g. d., "Ivington Lass 2nd," by "Sir Richard" (3460); gr. g. d., "Ivington Lass," by "Dan O'Connell" (1952); gr. g. g. d., "No. 87," by "Mortimer" (1328).

656 HERBERT RICHARD HALL, Holme Lacy, Hereford: SECOND PRIZE, 10*l.*, for "Gay Lass"; was calved January 5th; bred by himself; sire, "Horace Cremorne" (10,085): dam, "Gay," by "Dale Tredegar" (5856); g. d., "Tiny," by "Preceptor" (4030); gr. g. d., "Pigeon," by "Artist" (2934); gr. g. g. d., "Rosebud," by "Major" (2629).

649 THE EARL OF COVENTRY, Croome Court, Severn Stoke: THIRD PRIZE, 5*l.*, for "Rosewater"; was calved February 27th; sire, "Rare Sovereign" (10,499); dam, "Rosemary," by "The Grove 3rd" (5081); g. d., "Rhodia 4th," by "Spartan" (5009); gr. g. d., "Rhodia," by "Subaltern" (2794); gr. g. g. d., "Norma," by "Bolingbroke" (1883): and
650 the *Reserve Number* for 650, "Camilla"; was calved January 7th; sire, "Minstrel" (8915); dam, "Camomile 2nd," by "Fisherman" (5913); g. d., "Camomile," by "Governor 3rd" (4619); gr. g. d., "Miss Chieftain," by "Silver Chief" (4952); gr. g. g. d., by "Macaroni" (2627); both bred by himself.

CLASS 72.—*Hereford Bull and two Heifers, all calved in the Year* 1886.‡

664 STEPHEN ROBINSON, Lynhales, Kington, Herefordshire: FIRST PRIZE, 20*l.*, for "The Squire"; was calved March 16th; sire, "Highland Laird" (7015); dam, "Primrose," by "Dauphine" (3058); g. d., "Daffodil," by "Bachelor" (2941). "White Spark 5th"; was calved January 5th; sire, "Rose Stock" (6651); dam, "White Spark 3rd," by "Horatius" (5390); g. d., "White Spark," by "Regulus" (4076). "Lily"; was calved January 28th; sire, "Rose Stock" (6651); dam, "Water Lily 2nd," by "The Major" (3514); g. d., "Water Lily," by "Sir Thomas" (2228); all bred by himself.

665 JOHN PRICE, Court House, Pembridge, Herefordshire: SECOND PRIZE, 10*l.*, for "Prince Alfred"; was calved April 26th; sire, "Monarch" (7858); dam, "Playful," by "Hotspur" (7028); g. d., "Plum 5th," by "Grand Duke" (5342). "Faithful"; was calved May 20th; sire, "Monarch" (7858); dam, "Flower 6th," by "Grand Duke" (5342); g. d., "Flower," by "Paragon" (2665). "Precious"; was calved March 2nd; sire, "Monarch" (7858); dam, "Plum 5th," by "Grand Duke" (5342); g. d., "Plum," by "Horace" (3877); all bred by himself.

666 WILLIAM TUDGE, Leinthall, Ludlow: the *Reserve Number* and *Highly Commended* for "Baron Wilton"; was calved April 22nd; sire, "Viscount Wilton" (11,824); dam, "Lady Lilian," by "The Doctor" (5045); g. d., "Lady Jane," by "Sir Roger" (4133). "Lady Wilton"; was calved January 6th; sire, "Lord Wilton" (4740); dam, "Cherry Blossom," by "Downton Boy" (5877); g. d., "Cherry 3rd," by "Sultan" (4163). "Elsie Wilton"; was calved January 17th; sire, "Lord Wilton" (4740); am, "Elsie 2nd," by "Downton Boy" (5877); g. d., "Elsie," by "Downton Grand Duke" (5878); all bred by himself.

CLASS 73.—*Devon Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

669 VISCOUNT FALMOUTH, Tregothnan, Probus, Cornwall: FIRST PRIZE, 20*l.*, for "Lord Wolseley"; was calved January 8th, 1884; bred by himself; sire, "Cairo" (1690); dam, "Remembrance" (3882), by "Cinnamon" (1039); g. d., "Photograph" (3758), by "Sunflower" (937); gr. g. d., "Picture 4th" (2224), by "Napoleon 3rd" (464); gr. g. g. d., "Picture" (337), by a bull bred by Mr. Davy.

‡ Given by the Hereford Herd Book Society.

672 RICHARD BICKLE, Bradstone Hall, Tavistock, Devon: SECOND PRIZE, 10*l.*, for "Champion" (1696); was calved July 14th, 1883; bred by the late Mr. Henry Davy, Penhole House, Launceston, Cornwall; sire, "Champion" (1522); dam, "Cowslip 3rd" (6225), by "Agricola 2nd" (1675); g. d., "Cowslip," by "Napoleon" (1173); gr. g. d., "Primrose," by "Warrior" (548).

670 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Taunton, Somerset: THIRD PRIZE, 5*l.*, for "General Gordon"; was calved February 12th, 1884; bred by himself; sire, "Lord Currypool" (1589); dam, "Moss Rose 3rd" (5532), by "Duke of Farrington" (1323); g. d., "Boucher's Moss Rose" (4124); gr. g. d., "Splendid 1st" (4955).

673 WILLIAM PERRY, Alder, Lewdown, R.S.O., Devon: the *Reserve Number* and *Highly Commended* for "Draughtsman"; was calved September 1st, 1883; bred by himself; sire, "Benedict" (1504); dam, "Dolly" (5247), by "Druid" (1317); g. d., "Dove" (4404), by "Alderman" (1268); gr. g. d., "Dairymaid" (3343), by "Baronet" (781); gr. g. g. d., "Dairymaid" (1900), by "Duke of Chester" (404).

CLASS 74.—*Devon Bulls calved in the Year* 1886.

679 JOHN HOWSE, Leighland, Washford, R. S. O., Somerset: FIRST PRIZE, 20*l.*, for "The Vicar"; was calved January 16th; sire, "Druid" (1317); dam, "Lily 6th," by "Young Profit's Duke"; g. d., "Lily 4th" (4684), by "Master Bertie" (1402); gr. g. d., "Lily 3rd" (4683), by "Robin
680 Hood" (914): and SECOND PRIZE, 10*l.*, for 680, "Lord Leighland 2nd"; was calved May 15th; sire, "Druid" (1317); dam, "Daisy 4th" (5224), by "Nelson" (1413); g. d., "Daisy 1st" (4360), by Mr. Hancock's Bull; both bred by himself.

677 RICHARD BICKLE, Bradstone Hall, Tavistock, Devon: THIRD PRIZE, 5*l.*, for "Fancy's Robin"; was calved March 28th; bred by himself; sire, "Gladstone" (1737); dam, "Fancy" (5297), by "Stockley Prince" (1454); g. d., "Queen 2nd" (3859), by "Leviathan" (1143); gr. g. d., "Queen" (2994), by "Raglan" (713); gr. g. g. d., "Favourite," by "Napoleon" (462).

676 JOHN WALTER, Bearwood, Wokingham, Berkshire: the *Reserve Number* and *Highly Commended* for "Benedict 2nd"; was calved June 2nd; bred by himself; sire, "Benedict" (1504); dam, "Famous 7th" (7304), by "Royal Aston" (1437); g. d., "Famous 3rd" (4451), by "Croydon Boy" (1309); gr. g. d., "Famous 2nd" (3465), by "Eclipse" (835); gr. g. g. d., "Famous" (2685), by "Gold-Seeker" (848).

CLASS 75.—*Devon Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

684 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Taunton: FIRST PRIZE, 15*l.*, for "Moss Rose 8th" (7017); was calved February 5th, 1881; in-milk; calved February 6th, 1887; bred by the late Mr. Farthing, Stowey Court, Bridgwater; sire, "Lord Stowey" (1601); dam, "Moss Rose 5th" (4758), by a Son of "Forester" (1108); g. d., "Moss Rose" (3716), by "Island Prince" (862); gr. g. d. "Modesty."

682 JOHN WALTER, Bearwood, Wokingham: SECOND PRIZE, 10*l.*, for "Norah 7th" (7171); was calved April 18th, 1883; in-calf; bred by Mr. Surridge, Colford, Bishop's Lydeard, Taunton; sire, "Lord Currypool" (1589); dam, "Norah 2nd" (7167), by "Admiral" (1267); g. d., "Norah

1st" (2894*b*), by bull bred by Mr. Stuckey; gr. g. d., "Young Nerissa" (3129), by bull bred by Mr. Gibbs; gr. g. g. d., "Nelly" (2893*a*), by bull bred by Mr. Gibbs.

687 Sir William Williams, Bart., Heanton, Barnstaple, Devon: Third Prize, 5*l.*, for "Flame" (5868); was calved April 17th, 1883; in-calf; bred by himself; sire, "Duke of Flitton 17th" (1544); dam, "Famous 4th" (5291), by "Lord Stowey" (1601); g. d., "Famous 2nd" (5289), by "Master Willie" (1163); gr. g. d., "Famous" (4448), by a Son of "Lord Quantock" (874); gr. g. g. d., "Famous" (1965), by "Duke of Chester" (404).

685 Alfred C. Skinner, Bishop's Lydeard: the *Reserve Number* and *Highly Commended* for "Duchess 12th"; was calved August 11th, 1884; in-calf; bred by himself; sire, "Lord Currypool" (1589); dam, "Duchess 7th" (5260), by "Duke of Farrington" (1323); g. d., "Duchess 3rd" (4418), by "Sir Wroth" (1451); gr. g. d., "Boucher's Duchess" (4123).

Class 76.—*Devon Heifers, calved in the Year* 1885.

689 Sir William Williams, Bart., Heanton, Barnstaple: First Prize, 15*l.*, for "Frantic"; was calved March 25th; bred by himself; sire, "Duke of Flitton 17th"; dam, "Gentle," by a bull bred by Mr. John Quartly; g. d., "Gentle 1st."

688 Her Majesty the Queen, Flemish Farm, Windsor: Second Prize, 10*l.*, for "Fanciful"; was calved February 17th; in-calf; bred by Her Majesty; sire, "Lord Currypool" (1589); dam, "Fancy 5th" (5293), by "Lily's Robin" (1582); g. d., "Fancy 3rd" (4478), by "Red Prince" (1432); gr. g. d., "Fancy 1st" (4476), by Mr. W. M. Gibbs's bull; gr. g. g. d., "Fancy," bred by Mr. Skinner.

692 Alfred C. Skinner, Pound Farm, Bishop's Lydeard: Third Prize, 5*l.*, for "Lady Passmore 4th"; was calved February 22nd; bred by himself; sire, "Lord Cutsey 2nd" (1767); dam, "Lady Passmore 3rd" (7013), by "Lord Stowey" (1601); g. d., "Lady Passmore" (4657), by a Quartly bull.

690 John Walter, Bearwood, Wokingham: the *Reserve Number* and *Highly Commended* for "Dairymaid 5th"; was calved June 5th; in-calf; bred by himself; sire, "Tempter" (1852); dam, "Dairymaid 2nd" (4321), by "Master Willie" (1163); g. d., "Young Dairymaid" (4018), by "Master Alic" (881); gr. g. d., "Dairymaid" (2614), by "Viscount" (746); gr. g. g. d., "Dairymaid" (1259), by "Earl of Exeter" (38).

Class 77.—*Devon Heifers, calved in the Year* 1886.

694 John Walter, Bearwood, Wokingham: First Prize, 15*l.*, for "Buttercup 5th"; was calved June 15th; bred by himself; sire, "Lord Stowey" (1601); dam, "Buttercup 4th" (5136), by "Lily's Robin" (1582); g. d., "Buttercup 3rd" (5135), by "Lord Leigh" (1389); gr. g. d., "Buttercup 2nd" (4163), by "Goliath" (1350); gr. g. g. d., "Buttercup 1st" (4162), by "Samson" (1442).

696 Alfred C. Skinner, Pound Farm, Bishop's Lydeard: Second Prize, 10*l.*, for "Myrtle 23rd"; was calved April 24th; bred by himself; sire, "Lord Currypool" (1589); dam, "Myrtle 9th" (5546), by "Duke of Farrington" (1323); g. d., "Myrtle 3rd" (4767), by "Red Prince" (1432).

697 William Perry, Alder, Lewdown, R.S.O., Devon: Third Prize, 5*l.*, for "Duchess of Alder"; was calved July 3rd; bred by himself; sire, "Bravo" (1686); dam, "Dove" (4404), by "Alderman" (1268); g. d.,

"Dairymaid" (3343), by "Baronet" (781); gr. g. d., "Dairymaid" (1900), by "Duke of Chester" (404); gr. g. g. d., "Beauty" (29), by "Duke" (30).

693 SIR WILLIAM WILLIAMS, Bart., Heanton, Barnstaple: the *Reserve Number* and *Highly Commended* for "Flower 2nd"; was calved June 2nd; bred by himself; sire, "Eclipse"; dam, "Flower."

CLASS 78.—*Sussex Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

700 JOSEPH GODMAN, Park Hatch, Godalming, Surrey: FIRST PRIZE, 20*l.*, for "Nobleman" (707); was calved April 30th, 1884; bred by himself; sire, "Napoleon 3rd" (396); dam, "Cauliflower" (2199); g. d., "Comely" (1482).

699 WILLIAM STEWART FORSTER, Gore Court, Maidstone, Kent: SECOND PRIZE, 10*l.*, for "Mikado" (705); was calved January 15th, 1884; bred by Mr. A. Holmes, Rye, Sussex; sire, "Steyning" (729); dam, "Lily."

701 J. STEWART HODGSON, Lythe Hill, Haslemere, Surrey: the *Reserve Number* and *Highly Commended* for "Prince Rufus" (515); was calved July 31st, 1882; bred by himself; sire, "Young Oxford" (445); dam, "Laura 3rd" (2055), by "Little Tom"; g. d. "Laura 1st" (2053), by "Mottingham 1st" (190); gr. g. d., "Young Gentle."

CLASS 79.—*Sussex Bulls, calved in the Year* 1886.

705 J. STEWART HODGSON, Lythe Hill, Haslemere, Surrey: FIRST PRIZE, 20*l.*; was calved January 16th; bred by himself; sire, "Frankfort" (671); dam, "Peace 2nd" (2916), by "Royal Kilburn" (401); g. d., "Peace" (2273), by "Croydon" (245); gr. g. d., "Snowdrop" (1727), by "Egerton"; gr. g. g. d., "Leicester" (1120), by "Prince Arthur" (129).

704 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: SECOND PRIZE, 10*l.*, for "March"; was calved September 1st; bred by Messrs. E. and A. Stanford, Ashurst, Steyning, Sussex; sire, "Earl of Magdala 3rd" (586); dam, "Magdala 16th" (2427), by "Paris" (357); g. d., "Magdala 9th" (2255), by "Dorchester" (325); gr. g. d., "Magdala 3rd" (1185); gr. g. g. d., "Magdala 1st."

703 RICHARD CHRISTY, Watergate, Emsworth, Hants: the *Reserve Number* for "Bluebeard"; was calved February 20th; bred by Messrs. E. and A. Stanford; sire, "Reading" (516); dam, "Bluebell 2nd" (1924), by "Mentor" (253); g. d., "Bluebell" (1683).

CLASS 80.—*Sussex Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

707 WALTER BLANFORD WATERLOW, High Trees, Redhill, Surrey: FIRST PRIZE, 15*l.*, for "Elsa" (3214); was calved April 29th, 1884; in-milk; calved January 8th, 1887; bred by himself; sire, "Wallace" (478); dam, "Norma" (2272), by "The Czar" (312); g. d., "Nancy" (1871); gr. g. d., "Strawberry."

712 J. STEWART HODGSON, Lythe Hill, Haslemere: SECOND PRIZE, 10*l.*, for "Laura 7th" (3268); was calved January 6th, 1884; in-milk; calved April 12th, 1887; bred by himself; sire, "Lord Oxford" (461); dam, "Laura 3rd" (2055), by "Little Tom"; g. d., "Laura 1st" (2053), by "Mottingham 1st" (190); gr. g. d., "Young Gentle."

711 WILLIAM STEWART FORSTER, Gore Court, Maidstone, Kent: the *Reserve Number* and *Highly Commended* for "Prebble A 1" (3319); was calved April 16th, 1878; in-milk; calved August 8th, 1886; bred by Major Kirkpatrick, Horton Park, Hythe, Kent; sire, "Beckley" (241); dam, "Prebble P 1" (1876).

CLASS 81.—*Sussex Heifers, calved in the Year* 1885.

716 JOSEPH GODMAN, Park Hatch, Godalming, Surrey: FIRST PRIZE, 15*l.*, for "Noble Lady 2nd" (3451); was calved January 27th; bred by himself; sire, "Goldboy" (541); dam, "Noble Lady" (2911), by "Napoleon 3rd" (396); g. d., "Noble" (2270), by "The Baindèn Bull"; gr. g. d., "Noble" (1800), by "Sultan"; gr. g. g. d., by "Berry."

715 WILLIAM STEWART FORSTER, Gore Court, Maidstone: SECOND PRIZE, 10*l.*, for "Glory" (3736); was calved April 21st; bred by himself; sire, "Mabel Bull"; dam, "Splendour" (2145).

CLASS 82.—*Sussex Heifers, calved in the Year* 1886.

721 WILLIAM STEWART FORSTER, Gore Court, Maidstone: FIRST PRIZE, 15*l.*; was calved April 23rd; bred by himself; sire, "Mikado" (705); dam, "Splendour" (2145).

723 JOSEPH GODMAN, Park Hatch, Godalming: SECOND PRIZE, 10*l.*, for "Comely 9th" (3683); was calved January 16th; bred by himself; sire, "Goldboy" (541); dam, "Cherry" (2558), by "Napoleon 3rd" (396); g. d., "Cauliflower" (2199); gr. g. d., "Comely" (1482).

718 WALTER BLANFORD WATERLOW, High Trees, Redhill, Surrey: the *Reserve Number* and *Highly Commended* for "Ringley Maid" (3820); was calved March 19th; bred by himself; sire, "Golddust" (592); dam, "Old Mayflower 4th" (3082), by "Shirley" (436); g. d., "Old Mayflower" (2913), by "Willards Hill"; gr. g. d., "Young Mayflower" (2511).

CLASS 83.—*Red Polled Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

730 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: FIRST PRIZE, 20*l.*, for "Don Carlos" (659); was calved November 18th, 1882; bred by himself: sire, "King Charles" (329); dam, "Miss Atkins" (1023), by "Powell" (143); g. d., "Lady Atkins" (290), by "Norfolk Duke" (127); gr. g. d., "Primrose" (433), by "Tenant-Farmer" (213); gr. g. g. d., "Cherry" (K 17).

729 WILLIAM AMHURST TYSSEN-AMHERST, M.P., Didlington Hall, Brandon, Norfolk: SECOND PRIZE, 10*l.*, for "Didlington Davyson 2nd" (657); was calved January 7th, 1883; bred by himself; sire, "Davyson 12th" (481); dam, "Davy 24th" (1448), by "Davyson 5th" (287); g. d., "Davy 15th" (844), by "Davyson 3rd" (48); gr. g. d., "Davy 5th" (167), by "Tenant-Farmer" (213); gr. g. g. d., "Davy" (163).

731 JEREMIAH JAMES COLMAN, M.P., Norwich: the *Reserve Number* and *Highly Commended* for "Iago" (1025); was calved January 20th, 1885; bred by himself; sire, "Othello" (713); dam, "Silent Lady" (1855), by "Rufus" (188); g. d., "Silent Lass" (1189), by "Powell" (143); gr. g. d., "Silence" (549), by "Rifleman" (175); gr. g. g. d., "Silence" (O 9).

Class 84.—*Red Polled Bulls, calved in the Year* 1886.

733 John Hammond, Bale, Dereham, Norfolk: First Prize, 20*l*., for "Davyson 26th"; was calved March 8th; bred by himself; sire, "Lord Nelson"; dam, "Davy 28th," by "Davyson 6th."

735 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market, Suffolk: Second Prize, 10*l*., for "The Prince"; was calved May 16th; bred by himself; sire, "Perfect"; dam, "Catherine" (2678), by "Suffolk Baronet" (583); g. d., "Kattie" (975), by "Benedict" (17); gr. g. d., "Ringlet 2nd" (465), by "Tenant-Farmer" (213); gr. g. g. d., "Ringlet" (464), by "Hero of Newcastle" (85).

734 Jeremiah James Colman, M.P., Carrow House, Norwich: the *Reserve Number* for "Don Juan"; was calved August 13th; bred by himself; sire, "Don Carlos" (659); dam, "Cherry Leaf" (1383), by "Beau" (259); g. d., "Cherry 5th" (769), by "Norfolk Duke" (127); gr. g. d., "Cherry 2nd" (91), by "Norfolk Duke" (127); gr. g. g. d., "Cherry" (K. 17).

Class 85.—*Red Polled Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

737 William Amhurst Tyssen-Amherst, M.P., Didlington Hall, Brandon, Norfolk: First Prize, 15*l*., for "Emblem" (2782); was calved February 4th, 1884; in-milk; calved March 8th, 1887, and in-calf; bred by himself; sire, "Davyson 3rd" (48); dam, "Eleanor" (1477), by "Brutus" (269); g. d., "Elmer" (1483), by "Elmham Sire" (67).

738 John Hammond, Bale, Dereham, Norfolk: Second Prize, 10*l*., for "Davy 44th" (2136); was calved August 16th, 1882; in-milk; calved December 30th, 1886; bred by himself; sire, "Davyson 7th" (476); dam, "Davy 27th" (1451), by "Davyson 5th" (287); g. d. "Davy 5th," by "Tenant-Farmer."

740 Jeremiah James Colman, M.P., Carrow House, Norwich: the *Reserve Number* and *Highly Commended* for "Silent Lady" (1855); was calved December 18th, 1880; in-milk; calved March 5th, 1887; bred by himself; sire, "Rufus" (188); dam, "Silent Lass" (1189), by "Powell" (143); g. d., "Silence" (549), by "Rifleman" (175); gr. g. d., "Silence" (O 9).

Class 86.—*Red Polled Heifers, calved in the Year* 1885.

746 John Hammond, Bale, Dereham: First Prize, 15*l*., for "Davy 64th" (3362); was calved January 30th; bred by himself; sire, "Roland" (739); dam, "Davy 37th" (2130), by "Davyson 7th" (476); g. d., "Davy 21st" (1445), by "Davyson 5th" (287).

747 Jeremiah James Colman, M.P., Carrow House, Norwich: Second Prize, 10*l*., for "Silent Belle" (3739); was calved January 12th; bred by himself; sire, "Haman" (499); dam, "Silent Beauty" (2536), by "King Charles" (329); g. d., "Silent Lass" (1189), by "Powell" (143); gr. g. d., "Silence" (549), by "Rifleman" (175); gr. g. g. d., "Silence" (O 9).

750 Lord Hastings, Melton Constable, East Dereham, Norfolk: the *Reserve Number* and *Highly Commended* for "Violet" (3808); was calved February 5th; bred by himself; sire, "Roscoe" (559); dam, "Thornham Davy" (1890), by "Thornham Duke 2nd" (585); g. d.,

"Davy 16th" (845), by "Redjacket 7th" (179); gr. g. d., "Davy 7th" (169), by "Young Duke" (234); gr. g. g. d., "Davy 2nd" (H. 1), by "Sir Nicholas" (202).

CLASS 87.—*Red Polled Heifers, calved in the Year* 1886.

755 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: FIRST PRIZE, 15*l.*, for "Midget"; was calved February 4th; bred by himself; sire, "Ben" (795); dam, "Rosebud" (1797), by "Rufus" (188); g. d., "Rosebud" (494), by "Norfolk Duke" (127); gr. g. d., "Cherry 2nd" (91), by "Norfolk Duke" (127); gr. g. g. d., "Cherry" (K. 17).

754 JOHN HAMMOND, Bale, Dereham, Norfolk: SECOND PRIZE, 10*l.*, for "Davy 73rd"; was calved January 6th; bred by himself; sire, "Davyson 18th"; dam, "Davy 48th," by "Davy Butler"; g. d., "Davy 34th."

752 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: the *Reserve Number* and *Highly Commended* for "Curzon Caroline 2nd"; was calved March 9th; bred by themselves; sire, "Lancer" (689); dam, "Curzon Caroline" (2732), by "Falstaff" (303); g. d., "Curzon" (813), by "Money" (352).

CLASS 88.—*Aberdeen-Angus Bulls, calved in either* 1882, 1883, *or* 1884.

757 LORD TWEEDMOUTH, Guisachan, Beauly, Inverness, N.B.: FIRST PRIZE, 20*l.*, and CHAMPION PRIZE, 25*l.*,† for "Cash" (4558); was calved December 15th, 1884; bred by himself; sire, "Mosstrooper" (2256); dam, "Frailty" (4932), by "Judge" (1150); g. d., "Fair Lady" (2159), by "Victor of Ballindalloch" (403); gr. g. d., "Lady Fanny" (971), by "King Charles" (236); gr. g. g. d., "Young Mary" (527).

758 CLEMENT STEPHENSON, Balliol College Farm, Long Benton, Newcastle-on-Tyne: SECOND PRIZE, 10*l.*, for "Evander" (3717); was calved January 19th, 1884; bred by Sir G. Macpherson Grant, Bart., Ballindalloch, N.B.; sire, "Julius" (1819); dam, "Evening" (4187), by "Electro" (595); g. d., "Eva" (984), by "Victor of Ballindalloch" (403); gr. g. d., "Eisa" (977), by "Trojan" (402); gr. g. g. d., "Erica" (843), by "Cupbearer" (59).

760 THOMAS SMITH, Powrie, Dundee, Forfar, N.B.: THIRD PRIZE, 5*l.*, for "Norfolk" (3082); was calved August 10th, 1882; bred by himself; sire, "Monarch" (1182); dam, "Naomi 2nd of Powrie" (6688), by "Norman of Powrie" (1257); g. d., "Naomi of Powrie" (3730), by "Bachelor" (690); gr. g. d., "Prudence" (1809), by "Clansman" (398); gr. g. g. d., "Duchess of Drumin" (1681), by "Marshall" (399).

756 HER MAJESTY THE QUEEN, Abergeldie Mains, Crathie, N.B.: the *Reserve Number* and *Highly Commended* for "Baron Heath"; was calved April 7th, 1882; bred by Mr. J. Ross, Dounsdale, Tarland, Aberdeenshire; sire, "Prince Albert of Boads" (1336); dam, "Heatherbell 4th," by "First Baron Kelly"; g. d., "Heatherbell 3rd," by "Lord Kelly"; gr. g. d., "Heatherbell of Easttown," by "Commodore"; gr. g. g. d., "Patricia."

CLASS 89.—*Aberdeen-Angus Bulls calved in the Year* 1885.*

765 LORD TWEEDMOUTH, Guisachan, Beauly, N.B.: FIRST PRIZE, 20*l.*, for "Despot of Guisachan" (5289); was calved December 25th; bred by

† Given by the Polled Cattle Society for the best male Aberdeen-Angus.

himself; sire, "Apollo" (2456); dam, "Morcar" (6216), by "Ethelred" (1440); g. d., "Melody" (3338), by "Adrian 2nd" (622); gr. g. d., "Mabel of Drumin" (2217), by "Byron" (639); gr. g. g. d., "Ruby" (951), by "Jim Crow" (344).

766 MAJOR H. F. DENT, Ainderby Hall, Northallerton, Yorkshire: SECOND PRIZE, 10*l.*, for "Janus" (4755); was calved April 21st, 1885; bred by Sir G. Macpherson Grant, M.P., Ballindalloch, N.B.; sire, "Bushman" (2011); dam, "Judy" (2996), by "Baltimore" (2011); g. d., "Jilt" (973), by "Black Prince of Tillifour" (366); gr. g. d., "Beauty of Tillifour 2nd" (1180), by "Young Jock" (4); gr. g. g. d, "Favourite" (2), by "Grey-breasted Jock" (2).

767 OWEN C. WALLIS, of Bradley Hall, Wylam-on-Tyne: THIRD PRIZE, 5*l.*, for "Mescal" (5568); was calved April 4th; bred by Mr. James Scott, Easter Tulloch, Stonehaven, Kincardine, N.B.; sire, "Davie" (2046); dam, "Margaret 7th" (7648), by "Jock of Easter Tulloch" (992); g. d., "Margaret of Easter Tulloch" (3561), by "Prince of Wales 2nd" (394); gr. g. d., "Bamba" (1200), by "Duke of Wellington" (219); gr. g. g. d., "Bengie" (276), by "Stanley of Porthlethen" (14).

764 GEORGE REID, Clinterty, Blackburn, Aberdeen: the *Reserve Number* and *Highly Commended* for "Clan Duff" (4573); was calved January 8th; bred by the late Mr. W. J. Tayler, Rothiemay House, Huntley, Aberdeen; sire, "Sir Maurice" (1319); dam, "Crocus 2nd" (3765), by "Young Viscount" (736); g. d., "Crocus" (1400), by "Squire" (436); gr. g. d., "Fanny of Montbletton" (1404), by "Sambo 2nd" (470); gr. g. g. d., "Floret" (1405), by "Tam-o'-Shanter" (491).

CLASS 90.—*Aberdeen-Angus Bulls, calved in the Year* 1886.

771 ANDREW MACKENZIE, Dalmore, Alness, Ross-shire: FIRST PRIZE, 20*l.*, for "Esquire" (5346); was calved April 27th; bred by Sir G. Macpherson Grant, Bart., M.P., Ballindalloch, N.B.; sire, "Iliad" (2843); dam, "Ella" (7045), by "Young Viscount" (736); g. d., "Edina" (2987), by "Balliemore" (741); gr. g. d., "Enchantress" (981), by "Trojan" (402); gr. g. g. d., "Erica" (843), by "Cupbearer" (59).

779 THE EARL OF STRATHMORE, Glamis Castle, Forfar, N.B.: SECOND PRIZE, 10*l.*, for "Siberian"; was calved January 27th; bred by himself; sire, "Provost" (1259); dam, "Sybil 4th" (4326), by "Cluny" (1283); g. d., "Sybil 2nd of Tillyfour" (3526), by "Sir Garnet" (684); gr. g. d., "Sybil 1st of Tillyfour" (3524), by "Sir William" (705); gr. g. g. d., "Fancy of Boads" (1948).

773 MISS MORISON DUNCAN, Naughton, Newport, Fife: THIRD PRIZE, 5*l.*, for "Pride of War"; was calved January 30th; bred by Lord Tweedmouth, Guisachan, Beauly, N.B.; sire, "Mosstrooper" (2256); dam, "Pride of Glory" (6219), by "Heir of Glory" (1746); g. d., "Pride of Aberdeen 11th" (3255), by "Macduff 2nd" (1347); gr. g. d., "Pride 3rd of Mulben" (3249), by "Elgin" (724); gr. g. g. d., "Pride of Mulben" (1919), by "Jim Crow 4th" (352).

775 CLEMENT STEPHENSON, Balliol College Farm, Long Benton, Newcastle-on-Tyne: the *Reserve Number* and *Highly Commended* for "Eclat" (5320); was calved May 16th; bred by himself; sire, "Evander" (3717); dam, "Elissa" (7934), by "Editor" (1460); g. d., "Easter" (4540), by "Challenger" (1260); gr. g. d., "Erica 6th" (3023), by "Major of Bognie" (444); gr. g. g. d., "Erica 4th" (1197), by "Trojan" (402).

CLASS 91.—*Aberdeen-Angus Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

786 CLEMENT STEPHENSON, Balliol College Farm, Long Benton: FIRST PRIZE, 15*l.*, for "Lady Victorine" (8236); was calved January 29th, 1884; in-milk; calved December 21st, 1886, and in-calf; bred by the Hon. C. Carnegie, Mount Melville, St. Andrew's; sire, "Royal Victor" (1780); dam, "Lady Day" (2433), by "Elector" (427); g. d., "Grace Darling 2nd" (1071), by "Priam" (467).

792 THOMAS SMITH, Powrie, Dundee: SECOND PRIZE, 10*l.*, for "May 8th" (7750); was calved April 30th, 1882; in-calf; bred by himself; sire, "Monarch" (1182); dam, "May 4th" (4473), by "Norman of Powrie" (1257); g. d., "May 3rd" (3728), by "Bluebeard 2nd" (993); gr. g. d., "May 2nd" (3727), by "Porty" (649); gr. g. g. d., "May of Easter Tulloch" (3732), by "Theodore" (393).

781 HER MAJESTY THE QUEEN, Balmoral: THIRD PRIZE, 5*l.*, for "Princess Irene"; was calved April 6th, 1882; in-milk; calved March 22nd, 1887; bred by Her Majesty; sire, "Prince Victor of Daugh" (1865); dam, "Blossom 2nd of Westside" (3951), by "Logie the Laird 4th" (892); g. d., "Blossom of Westside" (2490), by "Harry 2nd" (770); gr. g. d., "Griggot" (2034).

793 THOMAS SMITH, Powrie: the *Reserve Number* and *Highly Commended* for "Ruby 5th of Powrie" (6090); was calved June 3rd, 1881; in-milk; calved March 6th, 1887; bred by himself; sire, "Monarch" (1182); dam, "Ruby 3rd of Powrie" (4474), by "Norman of Powrie" (1257); g. d., "Ruby 2nd of Easter Tulloch" (3520), by "Emperor of Easter Tulloch" (396); gr. g. d., "Ruby of Easter Tulloch" (1723), by "Prince of Wales 2nd" (394); gr. g. g. d., "Ruth of Melville" (1408), by "Theodore" (393).

CLASS 92.—*Aberdeen-Angus Heifers, calved in the Year* 1885.

808 CLEMENT STEPHENSON, Balliol College Farm, Long Benton, Newcastle-on-Tyne: FIRST PRIZE, 15*l.*, for "Pride of Englishman" (10,580); was calved January 21st; bred by himself; sire, "Englishman" (2076); dam, "Pride of Aberdeen 16th" (3302), by "Gainsborough 3rd" (598); g. d., "Pride of Mulben 2nd" (2359), by "Lochiel" (723); gr. g. d., "Pride of Mulben" (1919), by "Jim Crow 4th" (352); gr. g. g. d., "Pride of Aberdeen 5th" (1174), by "Bright" (454).

807 MISS MORISON DUNCAN, Naughton, Newport, Fifeshire: SECOND PRIZE, 10*l.*, for "Melissa Grace" (10,569); was calved January 25th; in-calf; bred by the Earl of Southesk, K.T., Kinnaird Castle, Brechin, N.B.; sire, "Sylvio" (3281); dam, "Mary Grace" (4066), by "Braes O'Mar" (715); g. d., "Charlotte of Fyvie" (1893), by "Captain of Fyvie" (712); gr. g. d., "Fyvie Flower" (1516), by "Malcolm of Bodiechell" (269).

810 OWEN CLARK WALLIS, Bradley Hall, Wylam-on-Tyne, Co. Durham: THIRD PRIZE, 5*l.*, for "Pride Shapely" (10,734); was calved April 11th; in-calf; sire, "Comus" (2628); dam, "Pride of Skene" (3193), by "His Lordship" (838); g. d., "Pride 3rd" (1694), by "Baronet of Drumin" (637); gr. g. d., "Pride" (957), by "President 4th" (368); gr. g. g. d., "Pride of Aberdeen 3rd" (1168), by "Black Prince of
811 Tillyfour" (366): and the *Reserve Number* and *Highly Commended* for 811, "Ermyntrude" (10,729); was calved March 5th; sire, "The Proud Knight" (1922); dam, "Ermin" (3532), by "Scotia" (789); g. d.,

"Editha" (1737), by "Windsor Augustus" (618); gr. g. d., "Ella" (1205), by "Kildonan" (405); gr. g. g. d., "Erica" (843), by "Cup-bearer" (59); both bred by himself.

CLASS 93.—*Aberdeen-Angus Heifers, calved in the Year* 1886.

814 CLEMENT STEPHENSON, Balliol College Farm, Long Benton: FIRST PRIZE, 15*l.*, and CHAMPION PRIZE, 25*l.*,† for "Fanny of Benton" (11,769); was calved February 13th; bred by himself; sire, "Sheik" (4290); dam, "Fanny of Boghead" (3341), by "Leo of Boghead" (570); g. d., "Flora of Boghead" (1439), by "Jupiter of Boghead" (569); gr. g. d., "Alice" (1092), by "Adair" (415); gr. g. g. d., "Susannah" (1270), by "Garibaldi" (504).

824 GEORGE SMITH GRANT, Auchorachan, Glenlivet, Ballindalloch, Banff: SECOND PRIZE, 10*l.*, for "Dayflower 2nd" (11,498); was calved January 22nd; bred by Mr. A. Mann, Ballintomb, Grantown, N.B.; sire, "King Pat" (2893); dam, "Dayflower" (5810), by "Warrior" (1291); g. d., "Dandelion" (2569), by "Pluto" (602); gr. g. d., "Duchess 4th" (944), by "March" (355); gr. g. g. d., "Duchess of Westertown," by "Rob Roy Macgregor" (267).

815 CLEMENT STEPHENSON, Long Benton: THIRD PRIZE, 5*l.*, for "Sunray" (11,777); was calved January 11th; bred by himself; sire, "Evander" (3717); dam, "Southesk 5th" (4420), by "Royal Hope" (1207); g. d., "Southesk 4th" (3604), by "Captain of Bognie" (579); gr. g. d., "Southesk 2nd" (1051), by "Odin 1st" (498).

812 ANDREW MACKENZIE, Dalmore, Alness, Ross-shire: the *Reserve Number* and *Highly Commended* for "Honey Dew 2nd" (11,397); was calved January 2nd; bred by himself; sire, "Paris" (1473); dam, "Honesty 3rd" (3754), by "Scotia" (789); g. d., "Honesty" (1690), by "Clansman" (398); gr. g. d., "Young Lucy" (947), by "Young Panmure" (232); gr. g. g. d., "Lucy of Porthlethen" (287), by "Fyvie" (13).

CLASS 94.—*Galloway Bulls, calved in either* 1882, 1883, *or* 1884.

836 THE DUKE OF BUCCLEUCH AND QUEENSBERRY, K.T., Drumlanrig Castle, Thornhill, Dumfriesshire: FIRST PRIZE, 20*l.*, for "Kinsman 2nd of Drumlanrig" (1790); was calved January 1st, 1882; bred by himself; sire, "Harden 2nd" (1458); dam, "Atalanta of Drumlanrig" (3413), by "Black Prince of Drumlanrig" (546); g. d., "Antigone of Drumlanrig" (1663), by "Lochinvar" (520); gr. g. d., "Handsome of Drumlanrig" (1638), by "Kinsman" (538); gr. g. g. d., "Rose of Culmain" (2964), by "Mullock of Culmain" (1141).

837 JAMES CUNNINGHAM, Tarbreoch, Dalbeattie, Kirkcudbrightshire: SECOND PRIZE, 10*l.*, for "Lucky Times" (3058); was calved January 22nd, 1883; bred by Mr. R. Webster, Airds, New Galloway Station, N.B.; sire, "Spring" (1582); dam, "Fan 2nd of Airds" (4860), by "Emperor of Culmain" (1167); g. d., "Fan of Airds" (3601), by "Croftsman" (1295); gr. g. d., "Young Mary"; gr. g. g. d., "Curly."

833 PETER MORTON AND SONS, Pedderhill, Longtown, Cumberland: THIRD PRIZE, 5*l.*, for "Canny Scot of Kirkhill"; was calved April 11th, 1883; bred by Mr. J. Carruthers, Kirkhill, Moffat, Dumfriesshire; sire, "Jim Crow" (1581); dam, "Bella 2nd of Kirkhill" (3978), by "Samson"

† Given by the Polled Cattle Society for the best female Aberdeen-Angus.

(1179); g. d., "Bella by Belig"; gr. g. d., "Young Fancy," by "Donald" (1888); gr. g. g. d., "Fancy by Ranger."

838 Sir Henry Ralph Dane, Bart., Hutton-in-the-Forest, Penrith, Cumberland: the *Reserve Number* and *Highly Commended* for "Borderer" (3266); was calved June 6th, 1883; bred by Mr. James Cunningham, Tarbreoch, Dalbeattie, Dumfries; sire, "Harden" (1151); dam, "Lady Queen" (3277), by "Sir James of Lawshall" (826); g. d., "Mary of Lawshall."

Class 95.—*Galloway Bulls, calved in the Year* 1885.*

843 Sir Robert Jardine, Bart., M.P., Castlemilk, Lockerbie, Dumfries: First Prize, 20*l.*, and Champion Prize, 25*l.*,‡ for "Liberator of Balig" (3850); was calved January 24th; bred by Messrs. R. and J. Shennan, Balig, N.B.; sire, "Liberty of Balig" (1835); dam, "Lucy of Balig 11th" (7043), by "Duke of Edinburgh" (1417); g. d., "Lucy of Balig 7th" (3846), by "Duke of Drumlanrig" (667); gr. g. d., "Lucy of Balig 4th" (2663), by "Blaiket" (548); gr. g. g. d., "Lucy of Balig 2nd" (1388), by "Norman" (529).

844 Frederick E. Villiers, Closeburn Hall, Thornhill, N.B.: Second Prize, 10*l.*, for "Dictator" (3845); was calved January 12th; bred by Messrs. Shennan, of Balig, Kircudbright; sire, "Liberty of Balig" (1385); dam, "Dinah 5th of Balig" (4314), by "Duke of Edinburgh" (1417); g. d., "Dinah 4th of Balig" (3444), by "Duke of Drumlanrig" (667); gr. g. d., "Dinah 3rd of Balig" (3658), by "Norman" (529); gr. g. g. d., "Dinah of Balig" (1343), by "Mulloch of Culmain" (1141).

841 The Duke of Buccleuch and Queensberry, K.T., Drumlanrig: the *Reserve Number* and *Highly Commended* for "The Squire of Drumlanrig" (3737); was calved January 3rd; bred by himself; sire, "Stanley 3rd of Drumlanrig" (1793); dam, "Charlotte of Drumlanrig" (3819), by "Black Prince of Drumlanrig" (546); g. d., "Countess 3rd of Drumlanrig" (2987), by "Baron Douglas" (614); gr. g. d., "Nightingale of Drumlanrig" (1656), by "Prince Bismarck" (699); gr. g. g. d., "Maid Marion 4th" (1668), by "Sir John The Graham" (522).

Class 96.—*Galloway Bulls, calved in the Year* 1886.

849 The Duke of Buccleuch and Queensberry, K.T., of Drumlanrig Castle, Thornhill: First Prize, 20*l.*, for "Vich Jan Vohn of Closeburn" (4121); was calved February 17th; bred by Mr. F. E. Villiers, Closeburn Hall, Thornhill; sire, "John Highlandman" (1905); dam, "Forest Queen of Closeburn" (4513), by "Sim of Whitram" (562); g. d., "Forest Queen 2nd" (1423), by "Willie of Westburnflat" (523); gr. g. d., "Forest Queen" (1314), by "Sir Walter" (536); gr. g. g. d., "Fair Forrester" (1310), by "Hannibal" (201).

847 Rev. John Gillespie, Manswald Manse, Ruthwell, R.S.O., Dumfriesshire: Second Prize, 10*l.*, for "Lord John Scott" (4374); was calved January 3rd; bred by the Duke of Buccleuch, K.T., Drumlanrig Castle; sire, "Kinsman 2nd of Drumlanrig" (1790); dam, "Lady Jean of Drumlanrig" (4230), by "The Baron" (1203); g. d., "Beauty of Old Mill" (2718), by "Aird" (1110); gr. g. d., "Gifford of Old Mill" (2713), by "The Miller of Old Mill" (1055).

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‡ Given by the Galloway Cattle Society for the best male Galloway.

850 Sir Robert Jardine, Bart., M.P., Castlemilk, Lockerbie: Third Prize, 5*l.*, for "Soncy Lad" (4366); was calved February 8th; bred by himself; sire, "Rosebery of Castlemilk" (1679); dam, "Soncy Lady 2nd of Castlemilk" (10,265), by "Beaconsfield" (1344); g. d., "Soncy Lady of Castlemilk" (3047), by "Black Douglas" (668); gr. g. d., "Soncy of Lanrich" (3045).

852 Andrew Montgomery, Nether Hall, Castle Douglas, N.B.: the *Reserve Number* and *Highly Commended* for "Tidy's Champion" (4370); was calved March 27th; bred by Messrs. R. and J. Shennan, Balig, Kirkcudbright; sire, "Charmer" (3336); dam, "Tidy 4th" (3447), by "Duke of Drumlanrig" (667); g. d., "Tidy 2nd" (2654), by "Mick" (1042); gr. g. d., "Tidy" (2647), by "Geordie 2nd" (528); gr. g. g. d., "Flora McDonald" (360), by "Geordie of Riggfoot" (234).

Class 97.—*Galloway Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

866 Frederick E. Villiers, Closeburn Hall, Thornhill, N.B.: First Prize, 15*l.*, and Champion Prize, 25*l.*,‡ for "Vaudeville of Closeburn" (8134); was calved January 3rd, 1884; calved June 16th, 1886, and in-calf; bred by himself; sire, "John Highlandman" (1905); dam, "Fancy of Closeburn" (3794), by "Statesman" (630); gr. d., "Cherry of Blaiket" (2950), by "Skerving" (1121); gr. g. d., "Flower Girl," by "Sir Walter" (536).

863 Sir Robert Jardine, Bart., M.P., Castlemilk, Lockerbie: Second Prize, 10*l.*, for "Netty of Culmain" (4240); was calved February 27th, 1882; in-milk; calved January 18th, 1887; bred by Mr. Maxwell Clark, Culmain, Crocketford, Dumfriesshire; sire, "Competitor" (1784); dam, "Nancy of Culmain" (3003), by "Prince of Wales" (1041); g. d., "Blossom of Culmain" (2775), by "Mangerton" (525): and Third Prize, 5*l.*, for 862, "Braw Lady" (8805); was calved March 23rd, 1883; in-milk; calved January 12th, 1887; bred by Mr. R. Webster, Airds, New Galloway, N.B.; sire, "Osman Pacha" (1282); dam, "Maggie of Airds" (4091), by "Hector of Park Robin" (2137); g. d., "Soncy of Park Robin" (4676), by a grandson of "Bob Burns" (235); gr. g. d., "Polly of Clifton," by "Brother to Pretender" (2457).

854 Irving Mitchelson, Lynes, Brampton, Cumberland: the *Reserve Number* and *Highly Commended* for "Nellie 2nd of Lynes"; was calved May 4th, 1884; calved March 22nd, 1887, and in-calf; bred by himself; sire, "Prince Charlie of Pedderhill"; dam, "Nellie of Lynes," by "Miller o' Dee"; g. d., "Matilda of Lynes," by "Theodore"; gr. g. d., "Sally," by "Lanercost."

Class 98.—*Galloway Heifers, calved in the Year* 1885.

877 Sir Robert Jardine, Bart., M.P., Castlemilk, Lockerbie: First Prize, 15*l.*, for "Marigold" (9540); was calved January 16th; in-calf; bred by Mr. Andrew Montgomery, Nether Hall, Castle Douglas; sire, "Competitor" (1784); dam, "Betsy of Culmain" (3667), by "Queensberry" (1027); g. d., "Bertha of Culmain" (2992), by "Mangerton" (525); gr. g. d., "Lilly of Culmain" (2991).

‡ Given by the Galloway Cattle Society for the best female Galloway.

869 THOMAS BIGGAR AND SONS, Chapelton, Dalbeattie, Kirkcudbrightshire: SECOND PRIZE, 10*l.*, for "Caprice 3rd" (9500); was calved March 11th; bred by themselves; sire, "Crusader" (2858); dam, "Begonia" (3707), by "Norval" (1248); g. d., "Beauty" (3138), by "Marquis" (1409); gr. g. d., "Betsy" (3132), by "Barbour's Bull"; gr. g. g. d., "Canty."

876 SIR ROBERT JARDINE, Bart., M.P., Castlemilk: THIRD PRIZE, 5*l.*, for "Mignonette" (9542); was calved February 4th; in-calf; bred by Mr. Andrew Montgomery, Nether Hall; sire, "Statesman 2nd of Drumlanrig" (1786); dam, "Netty of Culmain" (4240), by "Competitor" (1784); g. d., "Nancy of Culmain" (3003), by "Prince of Wales" (1041); gr. g. d., "Blossom of Culmain" (2775), by "Mangerton" (525).

873 R. AND J. SHENNAN, Balig, N.B.: the *Reserve Number* and *Highly Commended* for "Jenny Liberty" (9638); was calved January 10th; bred by themselves; sire, "Liberty of Balig" (1835); dam, "Jenny Alfred" (7040), by "Duke of Edinburgh" (1417): g. d., "Jenny Norman 3rd" (2650), by "Norman" (529); gr. g. d., "Jenny Goat" (1347), by "The Goat" (527); gr. g. g. d., "Jenny Burns" (1334), by "Bob Burns" (235).

CLASS 99.—*Galloway Heifers, calved in the Year* 1886.

888 SIR ROBERT JARDINE, Bart., M.P., Castlemilk, Lockerbie: FIRST PRIZE, 15*l.*, for "Rose Royal" (10,294); was calved January 2nd; bred by Mr. Andrew Montgomery, Nether Hall, Castle Douglas; sire, "Queensberry 4th" (1785); dam, "Braw Lady" (8805), by "Osman Pasha" (1282); g. d., "Maggie of Airds" (4091), by "Hector of Park Robin" (2137); gr. g. d., "Soucy of Park Robin" (4676), by a grandson of "Bob Burns" (235); gr. g. g. d., "Polly of Clifton," by "Brother to Pretender" (2457).

884 THOMAS BIGGAR AND SONS, Chapelton, Dalbeattie: SECOND PRIZE, 10*l.*, for "Cantatrice 4th" (10,087); was calved April 18th; bred by themselves; sire, "Crusader"; dam, "Cantatrice" (5569), by "The Monk" (1176); g. d., "Jenny Lind."

893 JAMES CUNNINGHAM, Tarbreoch, Dalbeattie, N.B.: THIRD PRIZE, 5*l.*, for "Violet 3rd of Tarbreoch" (9675); was calved March 30th; bred by himself; sire, "Scottish Borderer" (669); dam, "Maid 3rd of Tarbreoch" (3437), by "Chieftain of Drumlanrig" (752); g. d., "Maid 2nd of Tarbreoch" (2860), by "Marquis of Tarbreoch" (1049); gr. g. d., "Maid Marian 4th" (1668), by "Sir John the Graham"; gr. g. g. d., "Maid Marian 2nd," by "Glenorchy" (521).

889 FREDERICK E. VILLIERS, Closeburn Hall, Thornhill: the *Reserve Number* and *Highly Commended* for "Vigil 2nd of Closeburn" (9655); was calved February 27th; bred by himself; sire, "Verger of Closeburn" (3382); dam, "Vigil of Closeburn" (8128), by "Olden Times" (1369); g. d., "Jean of Gibbaldbreside" (5866), by "Kirkhill Jock" (2382).

CLASS 100.—*Highland Bulls, of any age.*

896 THE DUKE OF SUTHERLAND, K.G., Shinniss, Lairg, N.B.: FIRST PRIZE, 20*l.*, for "Rob Roy" (442), red; was calved May, 1878; bred by Mr. Donald McLaren, Corrychrone, Callander, Perthshire; sire, "Duke of Athole"; dam, "Dubh Mholack," by "Glen Tilt"; g. d., "Dubh Mholack"; gr. g. d., "Ruadh Mhor"; gr. g. g. d., "An Odhar Mhor":
897 and SECOND PRIZE, 10*l.*, for 897, "Glen Dhu," black; was calved January 7th, 1885; bred by himself; sire, "Rob Roy" (442); dam, "Ardsheal," by "Lochaber"; g. d., "Shiela."

899 GEORGE SAMPSON, Beauchief Abbey, Sheffield: THIRD PRIZE, 5*l.*, for "Prionnsa Dubh 2nd" (424), black; was calved in 1883; bred by Mr. Lawrie, Fincharn; sire, "Gilli Dubh of Fincharn"; dam, "Riabhach Og" (23); g. d., "Riabhach Mhor"; gr. g. d., "Riabhach Moloch."

CLASS 101.—*Highland Cows or Heifers, in-milk or in-calf.*

900 THE DUKE OF SUTHERLAND, K.G., Shinniss, Lairg: FIRST PRIZE, 15*l.*, for "Tarrqheal," red; was calved January 7th, 1884; in-calf; bred by himself; sire, "Prionnsa Tearlach"; dam, "Kate," by "Gilli Dubh 2nd, of Onnaig"; g. d., "Dubh Mollach," by "Tonnaid Og" (535); gr. g. d., "Bess"; gr. g. g. d., "Mally."

902 GEORGE SAMPSON, Beauchief Abbey, Sheffield: SECOND PRIZE, 10*l.*, for "Abaidh," dun; in-calf; age and breeder unknown: and THIRD PRIZE, 5*l.*, for 903, "Riabhach Og," brindled; in-calf; age and breeder unknown.

901 SIR JOHN SWINBURNE, Bart., M.P., Capheaton, Newcastle-on-Tyne: the *Reserve Number* and *Highly Commended* for his red brindle; was calved April, 1880; in-milk; calved March 29th, 1887; bred by the late Mr. R. Macdonald, Ullinish, Skye; sire, "Quairang."

CLASS 102.—*Ayrshire Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

906 ROBERT OSBORNE, Drumjoan, Ochiltree, Ayrshire: FIRST PRIZE, 20*l.*, and CHAMPION PRIZE, 10*l.* 10*s.*,† for "Cock a Bendie," white and brown; was calved April 17th, 1884; bred by himself; sire, "Hover a Blink" (892); dam, "Prizer," by "Kirkmahoe."

904 ROBERT WARDROP, Garlaff, Cumnock, Ayrshire: SECOND PRIZE, 10*l.*, for "Ayrshire Lad of Garlaff," white and brown; was calved April 8th, 1885; bred by himself; sire, "King Coil" (431); dam, "Wastie 2nd," by "Champion"; g. d., "Wastie 1st."

907 MARK J. STEWART, M.P., Southwick, Dumfries, N.B.: THIRD PRIZE, 5*l.*, for "White Prince" (909), white and brown; was calved May 4th, 1883; bred by Mr. Patrick M. Coul, Wattiestan, Kilbirnie; sire, "Baron o' Bucklyvie" (281); dam, "Blossom of Wattiestan" (3377).

905 EDWARD ARTHUR ROBERTS, Woodlands, Greenhithe, Dartford, Kent: the *Reserve Number* and *Highly Commended* for "Silver King," white and black; was calved April 16th, 1883; bred by Mr. James Wallace, Piperhill, Ochiltree, Ayrshire; sire, "Hover a Blink" (892); dam, "Bank."

CLASS 103.—*Ayrshire Bulls, calved in the Year* 1886.

910 ROBERT OSBORNE, Drumjoan, Ochiltree: FIRST PRIZE, 20*l.*, for "Crags of Kyle," white and brown; was calved March 23rd; bred by Mr. A. Logan, Overton, Coylton, Ayr; sire, "Sam"; dam, "Robina."

908 ROBERT WARDROP, Garlaff, Cumnock: SECOND PRIZE, 10*l.*, for "King Charlie of Garlaff," white and brown; was calved April 13th; bred by Mr. J. Weir, Shield Mains, Coylton; sire, "Mequittiston Bob"; dam, "Janet."

† Given by the Ayrshire Herd-Book Society for the best male Ayrshire.

913 ROBERT WILSON, Manswraes, Kilbarchan, Renfrew: THIRD PRIZE, 5*l.*, for his white flecked; was calved in April; bred by Mr. James Weir, Mechlefield, Houston, Renfrew; sire, "Prince Charlie 2nd"; dam, "Beauty."

915 MARK JOHN STEWART, M.P., Southwick, Dumfries, N.B.: the *Reserve Number* and *Highly Commended* for "Star of Southwick," white and red speckled; was calved in February; bred by himself; sire, "Quicklime" (562); dam, "Betty of Orchardton."

CLASS 104.—*Ayrshire Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

923 MARK J. STEWART, M.P., Southwick: FIRST PRIZE, 15*l.*, and CHAMPION PRIZE, 10*l.* 10*s.*,† for "Bertie 2nd" (3217), brown and white; was calved July, 1880; in-calf; bred by Mr. Robert Meikle, Clockston, Tarbolton, Ayrshire; sire, "Pride of Clerkland"; dam, "Bertie," by "Billy of Clockston"; g. d., "Doddy" (1334).

916 JOHN HOLM, Jaapston, Neilston, Renfrew: SECOND PRIZE, 10*l.*, for "Annie," brown and white; was calved April, 1884; in-calf; bred by himself; sire, "Prince Alfred 2nd" (651); dam, "Daisy" (647).

921 ROBERT WILSON, Manswraes, Kilbarchan: THIRD PRIZE, 5*l.*, for "Yellow Bess" (2830); was calved April 20th, 1882; calved April, 1886, and in-calf; bred by the Duke of Buccleuch, Drumlanrig, Thornhill; sire, "Stanley 2nd" (338); dam, "Yellow Bess 2nd" (882).

917 JOHN HOLM, Jaapston: the *Reserve Number* and *Highly Commended* for "Brockie" (4560), brown and white; was calved April, 1883; in-calf; bred by himself; sire, "White Prince" (251); dam, "Ballimore."

CLASS 105.—*Ayrshire Heifers, calved in the Year* 1885.

925 ROBERT WILSON, Manswraes, Kilbarchan, Renfrew: FIRST PRIZE, 15*l.*, for "Lady Bright," white flecked; was calved in April; bred by Mr. James Wilson, Macherquhat, Colmonell, Ayr; sire, "Neil Gow" (1076); dam, "Nellie," by "Carston Prince"; g. d., "Old Stately": and SECOND
926 PRIZE, 10*l.*, for 926, "Topsy 3rd" (5030), white flecked; was calved in March; bred by Mr. John Allan, Lambroughton, Kilmains; sire, "Bold Briton" (1483).

927 MARK J. STEWART, M.P., Southwick, Dumfries: THIRD PRIZE, 5*l.*, for "Nelly," white and brown; was calved in March; bred by Mr. Osborne Drumjoan, Ayr; sire, "Hover a Blink" (892).

924 ROBERT WARDROP, Garlaff, Cumnock, Ayrshire: the *Reserve Number* and *Highly Commended* for "Rose a Lea of Garlaff," white and brown was calved April 16th; bred by himself; sire, "King Coil" (431); dam, "Dodaldy 2nd," by "Wattieston Prince"; g. d., "Dodaldy 1st," by "Champion"; gr. g. d., "Wastie 1st."

CLASS 106.—*Ayrshire Heifers, calved in the Year* 1886.

933 JOHN HOLM, Jaapston, Neilston, Renfrew: FIRST PRIZE, 15*l.*, for "White Rose," white; was calved January 12th; bred by himself sire, "White Prince 2nd" (1138); dam, "Maggie 4th" (3358).

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† Given by the Ayrshire Herd-Book Society for the best female Ayrshire.

929 ROBERT WARDROP, Garlaff, Cumnock: SECOND PRIZE, 10*l.*, for "Snowflake 3rd of Garlaff," white and brown; was calved March 8th; bred by himself; sire, "Hover a Blink" (892); dam, "Snowflake 2nd," by "King Coil" (431).

932 ANDREW MITCHELL, Barcheskie, Kirkcudbright: THIRD PRIZE, 5*l.*, for "Edith," white and brown; was calved in April: and the *Reserve*
931 *Number* and *Highly Commended* for 931, "Alice," white and brown; was calved in April; both bred by Mr. T. Barbour, Parkthorn, Dundonald, Ayrshire.

CLASS 107.—*Jersey Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

948 S. H. HYDE, Kempton Park, Sunbury-on-Thames, Middlesex: FIRST PRIZE, 20*l.*, for "Dog Fox," silver grey; was calved May 1st, 1884; bred by the late Mr. Cardus, Southampton; sire, "Baron Lionel" (994); dam, "Vixen," by "Dairy King" (211); g. d., "Velveteen," by "Grey Prince" (385).

937 THE HON. COPLESTONE R. G. W. BAMPFYLDE, Bretton Park, Wakefield: SECOND PRIZE, 10*l.*, for "St. Mary's King," brown; was calved December 1st, 1883; bred by Mr. Jean Carabin, St. Mary's, Jersey; sire, "Augurez King" (1317 E.H.B.); dam, "Allemande" (3726 J.H.B.).

945 THE DUKE OF PORTLAND, Welbeck Abbey, Worksop, Nottinghamshire: THIRD PRIZE, 5*l.*, for "Fun," dark grey; was calved January 11th, 1884; bred by Mr. George Simpson, Wray Park, Reigate; sire, "Farmer's Joy" (1075 E.H.B.); dam, "Frolic," by "Milkboy" (561 E.H.B.); g. d., "Fille d'Esprit," by "Eastern Chief" (170 E.H.B.); gr. g. d., "Miss Vernon" (113 J.H.B.).

951 JOSEPH BRUTTON, 7, Prince's Street, Yeovil, Somerset: the *Reserve Number* and *Highly Commended* for "Gordon," dark fawn; was calved July 2nd, 1885; bred by himself; sire, "Jersey Knight" (1707); dam, "Gipsy," by "Colonel Terry's Bull"; g. d., "Beauty."

CLASS 108.—*Jersey Bulls, calved in the Year* 1886.

972 PERCIVAL H. FOWLER, Watford, Herts: FIRST PRIZE, 20*l.*, for "Blue Khedive" (956 J.H.B.), blue grey; was calved March 18th; bred by Mr. Le Brocq, St. Ouen's, Jersey; sire, "Royal Khedive" (628 J.H.B.); dam, "Pigeonne" (1489).

963 HENRY JAMES CORNISH, Thornford, Sherborne, Dorset: SECOND PRIZE, 10*l.*, for "Bendigo" (895 J.H.B.), dark grey; was calved January 11th; bred by Mr. F. Le Brocq, Les Augurez, St. Peter's, Jersey; sire, "Wolseley" (2168 E.H.B.); dam, "St. John's Buttercup" (6155 J.H.B.).

970 THE DUKE OF NORTHUMBERLAND, Albury Park, Guildford, Surrey: THIRD PRIZE, 5*l.*, for "Royal Prince," dark; was calved July 18th; bred by himself; sire, "Baron Albury"; dam, "Ruby," by "Admiral" (975); g. d., "Nugget," by "Golden Ear" (365); gr. g. d., "Pearl," by "Banditt" (22); gr. g. d., "Black Pearl."

953 THE HON. COPLESTONE RICHARD G. W. BAMPFYLDE, Bretton Park, Wakefield: the *Reserve Number* and *Highly Commended* for "Ormonde," brown; was calved April 16th; bred by himself; sire, "St. Mary's King" (2001 E.H.B.); dam, "Narcissus," by "Hero" (1079); g. d., "Verbena 2nd," by "Kangaroo" (1126); gr. g. d., "Verbena," by "Tommy" (1265); gr. g. g. d., "Beauty," by an Island bull.

CLASS 109.—*Jersey Cows, in-milk or in-calf, calved previously to or in the Year* 1883.

983 HENRY JAMES CORNISH, Thornford, Sherborne: FIRST PRIZE, 15*l.*, for "Bragga," brown; was calved April 2nd, 1881; in-milk; calved April 16th, 1887; bred by Mr. J. Allier, St. Clement's, Jersey; sire, "Cetewayo" (1425 E.H.B.); dam, "Leonore" (2403 J.H.B.); g. d., "Samares" (201).

976 GEORGE SIMPSON, Wray Park, Reigate, Surrey: SECOND PRIZE, 10*l.*, for "Bessie" (149), grey fawn; was calved May 12th, 1879; in-milk; calved April 21st, 1887; bred by Mr. P. Mourant, St. Saviour's, Jersey; sire, "Noble 2nd" (1172 E.H.B.); dam, "Beauty" (J.H.B.).

975 THE HON. COPLESTONE RICHARD G. W. BAMPFYLDE, Bretton Park, Wakefield: THIRD PRIZE, 5*l.*, for "Lady Nina"; was calved in 1882; in-calf; imported; breeder unknown: and the *Reserve Number* and *Highly Com-*
974 *mended* for 974, "Athens," fawn grey; was calved March 17th, 1881; in-milk, and in-calf; bred by Mr. G. Barrette, St. John's, Jersey; sire, "Carlo" (1030); dam, "Dexterity" (2609 J.H.B.).

CLASS 110.—*Jersey Cows or Heifers, in-milk or in-calf, calved in the Year* 1884.

988 GEORGE SIMPSON, Wray Park, Reigate: FIRST PRIZE, 15*l.*, for "Rosy 3rd," yellow fawn; was calved January 26th; in-milk; calved March 29th, 1887; bred by himself; sire, "Wolseley" (401 J.H.B.); dam, "Rosy" (512 J.H.B.), by "Carlo" (180 J.H.B.); g. d., "Catherine" (1366).

994 S. H. HYDE, Kempton Park, Sunbury-on-Thames: SECOND PRIZE, 10*l.*, for "Geranium," fawn; was calved February 26th; calved April 30th, 1887; in-calf; bred by the late Mr. F. Bircham, Burhill, Surrey; sire, "Fuchsia"; dam, "Miriam," by "Gipsy Lad" (359); g. d., "Sallie," by "Steel" (842).

991 HENRY JAMES CORNISH, Thornford, Sherborne: THIRD PRIZE, 5*l.*, for "Peach Blossom," fawn; was calved April 20th; in-milk; calved April 22nd, 1887; bred by Mr. F. Le Brocq, St. Peter's, Jersey; sire, "Wolseley" (2165 E.H.B.); dam, "Apple Blossom" (554 J.H.B.), by "Victor"; g. d., "Valentine."

993 THOMAS SHAW, M.P., Oakes House Farm, Holywell Green, Halifax, Yorkshire: the *Reserve Number* and *Highly Commended* for "May Flower," grey; was calved December 10th; in-calf; bred by himself; sire, "The Speaker"; dam, "Rosette 2nd" (943 J.H.B.).

CLASS 111.—*Jersey Heifers, calved in the Year* 1885.

1001 GEORGE SIMPSON, Wray Park, Reigate: FIRST PRIZE, 15*l.*, for "Marjorie," fawn; was calved May 5th; in-calf; due to calve before the show; sire, "Farmer's Joy" (1075); dam, "Mentone," by "Orpheus" (1178); g. d., "Her Majesty," by "Jack": and SECOND PRIZE, 10*l.*,
1002 for 1002, "Patricia 4th," grey; was calved April 17th; in-milk; sire, "Farmer's Joy" (1075); dam, "Patricia," by "Romeo" (760); g. d., "Portia," by "Welcome" (933); gr. g. d., "Fleurie" (859 J.H.B.); both bred by himself.

1007 HENRY JAMES CORNISH, Thornford, Sherborne: THIRD PRIZE, 5*l.*, for "Rozel's Fuchsia," grey fawn; was calved in 1885; in-milk; bred by

Mr. J. Germain, Ville Maux, Rozel, Jersey; sire, "Brave" (392 J.H.B.); dam, "Weston" (4098 J.H.B.).

1010 Samuel Henry Hyde, Kempton Park, Sunbury-on-Thames: the *Reserve Number* and *Highly Commended* for "Golden Skin III.," grey fawn; was calved April 28th; in-calf; bred by Mr. Francis Le Brocq, Jun., St. Ouen's, Jersey; sire, "Baron II." (428 J.H.B.); dam, "Golden Skin" (5508 J.H.B.).

Class 112.—*Jersey Heifers, calved in the Year* 1886.

1032 Thomas Shaw, M.P., Oakes House Farm, Holywell Green, Halifax: First Prize, 15*l*., for "Countess," solid colour; was calved June 15th; bred by himself; sire, "The Speaker"; dam, "Rosette 2nd" (943 J.H.B.).

1035 Samuel Henry Hyde, Kempton Park, Sunbury-on-Thames: Second Prize, 10*l*., for "Velvet II.," fawn; was calved May 8th; bred by himself; sire, "Dog Fox"; dam, "Velvet," by "Baron Lionel" (994); g. d., "Velveteen" (374).

1028 Henry James Cornish, Thornford, Sherborne: Third Prize, 5*l*., for "Golden Primrose," fawn; was calved June 14th; bred by himself; sire, "King 3rd" (621 J.H.B.); dam, "Golden Skin 2nd," by "Nero du Coin"; g. d., "Golden Skin": and the *Reserve Number* and *Highly*
1029 *Commended* for 1029, "Philippa 5th," dark grey; was calved May 28th; bred by Mr. W. Alexander, St. Mary's, Jersey; sire, "Royal Khedive" (628 J.H.B.); dam, "Philippa 3rd" (1247 J.H.B.).

Class 113.—*Guernsey Bulls, calved in either* 1882, 1883, 1884, *or* 1885.

1043 William Anthony Glynn, Seagrove, Seaview, Isle of Wight: First Prize, 20*l*., for "Hopeful" (25 E.G.H.B.), orange fawn and white; was calved May 17th, 1884; bred by himself; dam, "Queen."

1039 The Express Dairy Company, College Farm, Finchley, Middlesex: Second Prize, 10*l*., for "Sterling" (157 E.G.H.B.), lemon fawn and white; was calved September 15th, 1884; bred by Mr. D. Bichard, Robergerie, Vale, Guernsey; sire, "Climax" (14 E.G.H.B.); dam, "Flossie" (309), by "Baron Rothschild" (57).

1042 William Anthony Glynn, Seagrove: Third Prize, 5*l*., for "Karick" (99 E.G.H.B), orange fawn and white; was calved June 16th, 1885; bred by himself; sire, "Bonnie Boy" (8 E.G.H.B.); dam, "Rosalie" (456 E.G.H.B.).

1041 The Hon. Mrs. A. Baillie Hamilton, Combs, Stowmarket, Suffolk the *Reserve Number* and *Highly Commended* for "Loyalist," (103 E.G.H.B.), orange red and white; was calved January 6th, 1885; bred by herself; sire, "Loyal" (37 E.G.H.B.); dam, "Buttercup" (34 E.G.H.B.).

Class 114.—*Guernsey Bulls, calved in the Year* 1886.

1047 The Hon. Mrs. A. Baillie Hamilton, Combs, Stowmarket: First Prize, 20*l*., for "Baron Vauxbelets 2nd" (126 E.G.H.B.), fawn and white; was calved June 19th; bred by Mr. J. James, Les Vauxbelets, St. Andrew, Guernsey; sire, "Baron Vauxbelets" (178); dam, "Lady Emily Foley 3rd" (1066), by "Squire of Les Vauxbelets" (69); g. d., "Lady Emily Foley 2nd" (1065); gr. g. d., "Lady Emily Foley" (82), by "Neptune" (85).

1049 EDWARD PARSONS FOWLER, Gloucester Square, Southampton: SECOND PRIZE, 10*l.*, for his red and white; breeder unknown.

1048 WILLIAM ANTHONY GLYNN, Seagrove, Seaview: the *Reserve Number* for "Prince," pale yellow fawn and white; was calved July 1st; bred by himself; sire, "Hopeful" (25 E.G.H.B.); dam, "Trolly" (363 E.G.H.B.).

CLASS 115.—*Guernsey Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1884.

1057 WILLIAM ANTHONY GLYNN, Seagrove, Seaview: FIRST PRIZE, 15*l.*, for "Fairy 2nd" (105 E.G.H.B.), lemon fawn and white; was calved April 11th, 1878; in-milk; calved January 3rd, 1887; bred by himself; sire, "Honest Tom"; dam, "Fairy 1st," by "Johnny 1st"; gr. g. d., "Jenny 1st."

1051 THE EXPRESS DAIRY COMPANY, College Farm, Finchley: SECOND PRIZE, 10*l.*, for "Plaisanterie" (1928 G.H.B.), orange fawn and white; was calved September 12th, 1884; calved May 8th, 1887; bred by Mr. W. Burridge, Ste. Hélène, St. Andrew, Guernsey; sire, "Welcome"; dam, "Lassie."

1058 WILLIAM ANTHONY GLYNN, Seagrove: THIRD PRIZE, 5*l.*, for "Fairy 3rd" (106 E.G.H.B.), lemon fawn and white; was calved June 5th, 1883; calved June 20th, 1886; due to calve before the show; bred by himself; sire, "Billy 4th" (7 E.G.H.B.); dam, "Fairy 2nd" (105 E.G.H.B.), by "Honest Tom"; g. d., "Fairy 1st," by "Johnny 1st"; gr. g. d., "Jenny 1st."

1055 CHRISTOPHER MIDDLETON, Marton, Middlesborough, Yorkshire: the *Reserve Number* and *Highly Commended* for "Deruchette," yellow and white; was calved in 1882; in-milk; calved March 2nd, 1887; breeder unknown.

CLASS 116.—*Guernsey Heifers, calved in the Year* 1885.

1063 WILLIAM ANTHONY GLYNN, Seagrove, Seaview: FIRST PRIZE, 15*l.*, for "Honesty 2nd" (374 E.G.H.B.), orange fawn and white; was calved February 4th; calved March 20th; bred by himself; sire, "Bonnie Boy" (8 E.G.H.B.); dam, "Honesty" (155 E.G.H.B.).

1060 THE EXPRESS DAIRY COMPANY, College Farm, Finchley: SECOND PRIZE, 10*l.*, for "Polly 3rd de la Charnée," orange fawn and white; was calved March 30th; in-calf; due to calve before the show; bred by Mr. J. Le Lièvre, Charnée, Vale, Guernsey; sire, "Luther" (199); dam,
1062 "Polly de la Charnée" (934): and the *Reserve Number* for 1062, "Seaside Belle" (1934), orange fawn and white; was calved March 25th; in-calf; due to calve before the show; bred by Mr. D. Le Cheminant, St. Peter's-in-the-Wood, Guernsey; sire, "Andros" (134); dam, "Bonnie."

CLASS 117.—*Guernsey Heifers, calved in the Year* 1886.

1072 WILLIAM ANTHONY GLYNN, Seagrove, Seaview: FIRST PRIZE, 15*l.*, for "Favourite 7th," orange fawn and white; was calved July 22nd; bred by himself; sire, "Champion" (9 E.G.H.B.); dam, "Favourite 4th" (111 E.G.H.B.), by "Billy 4th" (7 E.G.H.B.); g. d., "Favourite 2nd" (110 E.G.H.B.), by "Tommy"; gr. g. d., "Favourite 1st."

1070 THE HON. MRS. A. BAILLIE HAMILTON, Combs, Stowmarket: SECOND PRIZE, 10*l.*, for "Jessie 5th" (582 E.G.H.B.), red fawn and white; was calved August 16th; bred by herself; sire, "First Lord" (90 E.G.H.B.); dam, "Jessie 2nd" (162); g. d., "Jessie 1st."

1068 THE EXPRESS DAIRY COMPANY, College Farm, Finchley: THIRD PRIZE, 5*l.*, for "Lady Jane 6th" (598), solid fawn; was calved May 25th; sire, "Cloth of Gold 20th" (203); dam, "Lady Jane 2nd" (597): and the
1067 *Reserve Number* for 1067, "Brightsmile 3rd" (501 E.G.H.B.), orange fawn and white; was calved May 16th; sire, "Excelsior 7th" (111); dam, "Brightsmile" (500); both bred by themselves.

CLASS 118.—*Kerry (including Dexter-Kerry) Bulls, of any age.*

1076 JAMES HAY, The Farm, Abbey Leix, Queen's County, Ireland: FIRST PRIZE, 15*l.*, for "Feale," black; was calved June 15th, 1884; bred by Mr. Pierce Mahony, Kilmorna, Listowel, County Kerry; sire, "Aherlow"; dam, "Waterville."

1074 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: SECOND PRIZE, 10*l.*, for "Busaco 3rd," black; was calved December 13th, 1884; bred by the Dowager Lady Howard de Walden, The Mote, Maidstone, Kent:
1075 and the *Reserve Number* for 1075, "Moonlighter," black; was calved October 17th, 1886; bred by themselves; sire, "Busaco 3rd"; dam, "Granny."

CLASS 119.—*Kerry (including Dexter-Kerry) Cows or Heifers, of any age, in-milk or in-calf.*

1093 MARTIN JOHN SUTTON, Dyson's Wood, Kidmore, Reading, Berks: FIRST PRIZE, 15*l.*, for "Flora," black; was calved in July, 1879; in-milk; calved March 10th, 1887; bred by Mr. R. Good, Aherlow, County Cork.

1095 JAMES ROBERTSON, La Mancha, Malahide, Co. Dublin: SECOND PRIZE, 10*l.*, for "Vernal," black; was calved in June, 1882; calved September 24th, 1886, and in-calf; breeder unknown.

1086 THE AYLESBURY DAIRY COMPANY, Horsham: the *Reserve Number* for "Lady Waterford," black; in-milk; calved April 14th, 1887; age and breeder unknown.

CLASS 120.—*Dairy Cows (milking properties to be specially considered) in-milk, of any breed or cross, calved previously to or in the Year* 1883.§

1116 JOHN EDWARD GOODRICK, Hill-Foot House, Pannal, Harrogate, Yorkshire: FIRST PRIZE, 20*l.*, for "Dunwell," roan; cross-bred; age unknown; calved May 24th, 1887; bred by Mr. J. Dunwell, Swarthy Hill, Pannal.

1110 JAMES LOWTHER, Quarry House, Harperley, Co. Durham: SECOND PRIZE, 10*l.*, for his roan, cross-bred; was calved in 1882; calved August 29th, 1886; breeder unknown.

1115 JOHN GOODRICK, Hill-Foot House, Pannal: THIRD PRIZE, 5*l.*, for "Scottie," blue; cross-bred; calved May 20th, 1887; age and breeder unknown.

1111 MICHAEL WRIGHT, Charlton, Bellingham, Northumberland: the *Reserve Number* for his roan shorthorn; was calved March 30th, 1880; in-calf; bred by Messrs. Douglas, Sills, Otterburn, Northumberland.

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§ Given by the Medical Graduates of the University of Durham.

Class 121.—*Dairy Cows (milking properties to be specially considered), in-milk, of any breed, or cross, calved in the Year* 1884.

1119 John Jervis Sharp, Broughton, Kettering, Northamptonshire: First Prize, 20*l.*, for his red shorthorn; was calved January 5th; in-calf; due to calve before the show; bred by himself; sire, "Oxford Rose 3rd" (50,135); dam, "Julia 13th," by "Cambridge Duke 6th" (33,272); g. d., "Julia 11th," by "Satan" (27,430); gr. g. d., "Julia 9th," by "Lord Chancellor" (20,160); gr. g. g. d., "Julia 1st," by "Henry 5th" (19,944).

1106 Robert Burnside, Brankin Moor, Darlington, Co. Durham: Second Prize, 10*l.*, for his roan; cross-bred; was calved in January, 1884; breeder unknown.

1121 Christopher W. Wilson, Rigmaden Park, Kirkby Lonsdale: the *Reserve Number* for his Shorthorn; was calved in 1884; bred by himself.

SHEEP.

Class 122.—*Leicester Two-Shear Rams.*

1123 Teasdale H. Hutchinson, Manor House, Catterick, Yorkshire: First Prize, 15*l.*; was dropped in March, 1885; bred by himself.

1129 Robert Harrison, Underpark, Grosmont, Yorkshire: Second Prize, 10*l.*; was dropped in March, 1885; bred by himself.

1124 Teasdale H. Hutchinson, Catterick: Third Prize, 5*l.*; was dropped in March, 1885; bred by himself.

1127 William Walsh, Gilstead, Bingley, Yorkshire: the *Reserve Number*; was dropped in 1885; bred by Mr. J. B. Green, Low House Farm, Silsden, Leeds.

Class 123.—*Leicester Shearling Rams.*

1136 Teasdale H. Hutchinson, Manor House, Catterick: First Prize, 15*l.*,
1137 and Second Prize, 10*l.*, for 1137; were dropped in March, 1886; both bred by himself.

1142 Tom Strickland, Thirsk Junction, Thirsk, Yorkshire: Third Prize,
1143 5*l.*, and the *Reserve Number* and *Highly Commended* for 1143; were dropped in March, 1886; bred by Mr. J. B. Green, Low House Farm, Silsden.

Class 124.—*Leicester Ram Lambs, dropped in the Year* 1887—*Pens of Three.*

1155 William Walsh, Gilstead, Bingley: First Prize, 10*l.*; were dropped in February; bred by Mr. J. B. Green, Low House Farm.

1152 Teasdale H. Hutchinson, Manor House, Catterick: Second Prize, 5*l.*; were dropped in March; bred by himself.

1153 William Heslop, High House, Marwood, Barnard Castle, Co. Durham: the *Reserve Number* and *Commended*; were dropped about March 10th; bred by himself.

Class 125.—*Leicester Shearling Ewes—Pens of Five.*

1159 Ernest Francis Jordan, Eastburn, Driffield, Yorkshire: First Prize,
1158 15*l*., and Second Prize, 10*l*., for 1158; were dropped in April, 1886; all bred by himself.

1164 Robert Harrison, Underpark, Lealholm, Grosmont, Yorkshire: the *Reserve Number;* were dropped in March, 1886; bred by himself.

Class 126.—*Cotswold Two-Shear Rams.*

1165 Russell Swanwick, Royal Agricultural College Farm, Cirencester,
1166 Gloucestershire: First Prize, 15*l*., and Second Prize, 10*l*., for 1166; were dropped about February 14th, 1885; both bred by himself.

Class 127.—*Cotswold Shearling Rams.*

1168 Russell Swanwick, Royal Agricultural College Farm, Cirencester:
1170 First Prize, 15*l*., Second Prize, 10*l*., for 1170, and the *Reserve Number*
1171 for 1171; were dropped about February 10th, 1886; all bred by himself.

Class 128.—*Cotswold Ram Lambs, dropped in the Year* 1887—*Pens of Three.*

1176 Henry Akers, Black Bourton, Faringdon, Berks: First Prize, 10*l*.; were dropped on February 1st and 2nd; bred by himself.

1173 Russell Swanwick, the Royal Agricultural College Farm, Cirencester:
1174 Second Prize, 5*l*., and the *Reserve Number* and *Highly Commended* for 1174; were dropped about February 7th; all bred by himself.

Class 129.—*Cotswold Shearling Ewes—Pens of Five.*

1178 Russell Swanwick, Royal Agricultural College Farm, Cirencester: First Prize, 15*l*.; were dropped after February 10th, 1886; bred by himself.

1179 Henry Akers, Black Bourton, Faringdon: Second Prize, 10*l*.; were dropped February 4th and 5th, 1886; bred by himself.

Class 130.—*Lincoln Two-Shear Rams.*

1180 John Pears, Mere, Lincoln: First Prize, 15*l*.; was dropped in March, 1885; bred by himself.

1185 William Taylor Sharpe, Baumber Park, Horncastle, Lincolnshire: Second Prize, 10*l*.; was dropped about March 1st, 1885; bred by himself.

1181 Henry Dudding, Riby Grove, Great Grimsby, Lincolnshire: the *Reserve Number* and *Highly Commended;* was dropped about March 15th, 1885; bred by himself.

Class 131.—*Lincoln Shearling Rams.*

1188 Henry Smith, The Grove, Cropwell Butler, Nottingham: First Prize, 15*l*.; was dropped in March, 1886; bred by himself.

1190 Robert Wright, Nocton Heath, Lincoln: Second Prize, 10*l*., and
1189 the *Reserve Number* and *Highly Commended* for 1189; were dropped in March, 1886; both bred by himself.

CLASS 132.—*Lincoln Ram Lambs, dropped in the Year* 1887—*Pens of Three.*

1199 ROBERT WRIGHT, Nocton Heath, Lincoln: FIRST PRIZE, 10*l.*; were dropped in February or March; bred by himself.

1200 JOHN PEARS, Mere, Lincoln: SECOND PRIZE, 5*l.*; were dropped in February; bred by himself.

1202 HENRY DUDDING, Riby Grove, Great Grimsby: the *Reserve Number* and *Highly Commended*; were dropped about March 1st; bred by himself.

CLASS 133.—*Lincoln Shearling Ewes—Pens of Five.*

1206 HENRY DUDDING, Riby Grove, Great Grimsby: FIRST PRIZE, 15*l.*; were dropped about March 15th, 1886; bred by himself.

1204 ROBERT WRIGHT, Nocton Heath, Lincoln: SECOND PRIZE, 10*l.*; were dropped in March, 1886; bred by himself.

CLASS 134.—*Other Long-Woolled Two-Shear Rams.*

1209 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court, Tiverton, Devon: FIRST PRIZE, 10*l.*, for his Devon long-wool; was
1208 dropped March 21st, 1885: and SECOND PRIZE, 5*l.*, for 1208, Devon long-wool; was dropped February 27th, 1885; both bred by himself.

1214 JAMES PILKINGTON, Swinithwaite Hall, Bedale, Yorkshire: the *Reserve Number* and *Commended* for his Wensleydale long-wool: was dropped in March, 1885; bred by himself.

CLASS 135.—*Other Long-Woolled Shearling Rams.*

1218 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: FIRST PRIZE, 10*l.*, for his Devon long-wool; was dropped about February 1st, 1886; bred by himself.

1216 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court, Tiverton: SECOND PRIZE, 5*l.*, for his Devon long-wool; was dropped February 25th, 1886; bred by himself.

1219 ALFRED C. SKINNER, Bishop's Lydeard: the *Reserve Number* and *Commended* for his Devon long-wool; was dropped about February 1st, 1886; bred by himself.

CLASS 136.—*Other Long-Woolled Shearling Ewes—Pens of Five.*

1223 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court, Tiverton: FIRST PRIZE, 10*l.*, for his Devon long-wools; were dropped in February and March, 1886; bred by himself.

1224 JOHN HEUGH, Mudd Fields, Bedale, Yorkshire: SECOND PRIZE, 5*l.*, for his Wensleydale long-wools; were dropped in March, 1886; bred by himself.

1225 JAMES PILKINGTON, Swinithwaite Hall, Bedale: the *Reserve Number* and *Highly Commended* for his Wensleydale long-wools; were dropped in March, 1886; bred by himself.

CLASS 137.—*Oxfordshire Down Two-Shear Rams.*

1228 JOHN TREADWELL, Upper Winchendon, Aylesbury, Buckinghamshire: FIRST PRIZE, 15*l.*, for "Young Baron Oxford": was dropped about February 14th, 1885; bred by himself; sire, "Baron Oxford"; dam, "No. 81 of 1882," by "Comet."

1227 A. F. MILTON DRUCE, Fyfield, Abingdon, Berkshire: SECOND PRIZE, 5*l.*, for "Confusion"; was dropped about February 1st, 1885; bred by himself; sire, "Nonpareil."

CLASS 138.—*Oxfordshire Down Shearling Rams.*

1237 JOHN TREADWELL, Upper Winchendon, Aylesbury: FIRST PRIZE, 15*l.*,
for "Royal Jubilee No. 82"; was dropped about February 14th, 1886;
sire, "Royal Preston"; dam, "No. 56 of 1884," by "Young Freeland":
1235 SECOND PRIZE, 10*l.*, for 1235, "No. 15"; was dropped about February
1st, 1886; sire, "Young Freeland"; dam, "No. 13 of 1882," by
1236 "Hobb's No. 5": THIRD PRIZE,, 5*l.*, for 1236, "Baron Druce No. 89";
was dropped about February 14th, 1886; sire, "Excelsior"; dam,
"No. 96 of 1882," by "Wallis No. 7": and the *Reserve Number* and
1234 *Highly Commended* for 1234, "Royal Newcastle No. 14"; was dropped
about February 1st, 1886; sire, "Baron Bicester"; dam, "No. 106 of
1884," by "Young Comet"; all bred by himself.

CLASS 139.—*Oxfordshire Down Ram Lambs, dropped in the Year 1887—Pens of Three.*

1243 A. F. MILTON DRUCE, Fyfield, Abingdon: FIRST PRIZE, 10*l.*; were dropped about February 1st; bred by himself.

1244 GEORGE ADAMS, Royal Prize Farm, Pidnell, Faringdon: SECOND PRIZE, 5*l.*; were dropped in January; bred by himself; sire, "Grand Cote"; dam, by "Fyfield."

1250 A. F. MILTON DRUCE, Fyfield: the *Reserve Number;* were dropped about February 1st; bred by himself.

CLASS 140.—*Oxfordshire Down Shearling Ewes—Pens of Five.*

1252 GEORGE ADAMS, Royal Prize Farm, Pidnell, Faringdon, Berkshire: FIRST PRIZE, 15*l.*; were dropped in January, 1866; bred by himself; sire, "Grand Cote"; dam, by "Fyfield."

1255 THE COUNTESS CAMPERDOWN, Weston House, Shipston-on-Stour, Warwickshire: SECOND PRIZE, 10*l.*; were dropped about February 3rd; bred by herself.

1251 GEORGE ADAMS: the *Reserve Number;* were dropped in January, 1886; bred by himself; sire, "Grand Cote"; dam, by "Fyfield."

CLASS 141.—*Shropshire Two-Shear Rams.*

1261 THOMAS STEPHEN MINTON, Montford, Montford Bridge, R.S.O., Shropshire: FIRST PRIZE, 15*l.*; was dropped in March, 1885; bred by himself.

1265 ANDREW EVANS MANSELL, Broughton, Harmer Hill, Shrewsbury: SECOND PRIZE, 10*l.*; was dropped in March, 1885; bred by himself.

1257 JOHN and GEORGE GERMAN (executors of the late William German), Measham Lodge, Atherstone: THIRD PRIZE, 5*l.*; was dropped about April 1st, 1885; bred by themselves.

1268 HENRY and ARTHUR BRADBURNE, Pipe Place, Lichfield, Staffordshire: the *Reserve Number* and *Highly Commended;* was dropped in the first week in April, 1885; bred by themselves; sire, "The Rector" (1769); dam, by "Sir Arthur" (1728); g. d., by "Clinker 2nd."

CLASS 142.—*Shropshire Shearling Rams.*

1318 JOSEPH BEACH, The Hattons, Brewood, Staffordshire: FIRST PRIZE, 15*l.*,
1319 and SECOND PRIZE, 10*l.*, for 1319; were dropped the last week in February, 1886; both bred by himself.

1279 JOHN and GEORGE GERMAN (executors of the late William German), Measham Lodge, Atherstone: THIRD PRIZE, 5*l.*; was dropped about April 1st, 1886; bred by themselves.

1321 THOMAS and SAMUEL BRADBURNE, Astwood Hill, Redditch, Worcestershire: the *Reserve Number* and *Highly Commended;* was dropped about the middle of March, 1886; bred by the late Mr. John Coxon, Freeford, Lichfield; sire, "King Pin"; dam, by "Duke of York."

CLASS 143.—*Shropshire Ram Lambs, dropped in the Year* 1887—*Pens of Three.*

1340 RICHARD THOMAS, The Buildings, Baschurch, Shropshire: FIRST PRIZE, 10*l.*; were dropped in March; bred by himself.

1335 HENRY and ARTHUR BRADBURNE, Pipe Place, Lichfield: SECOND PRIZE, 5*l.*; were dropped in March; bred by themselves; sire, "The Rector" (1769).

1341 SIR ROBERT LODER, Bart., Whittlebury, Towcester, Northamptonshire: the *Reserve Number* and *Highly Commended;* were dropped March 1st; bred by himself; sire, "The Dean" (2356); dam, by "Chesham 2nd" (362).

CLASS 144.—*Shropshire Shearling Ewes—Pens of Five.*

1352 JOHN EDWARD FARMER, Felton, Ludlow, Shropshire: FIRST PRIZE, 15*l.*; were dropped in February or March, 1886; bred by himself.

1350 PHILIP ALBERT MUNTZ, M.P., Dunsmore, Rugby, Warwickshire: SECOND PRIZE, 10*l.*; were dropped in February and March, 1886; bred by himself; sires, "Lord Neptune" and "Lord Selwyn."

1351 MRS. BARRS, Odstone Hall, Atherstone: THIRD PRIZE, 5*l.*; were dropped about first week in March, 1886; bred by herself.

1355 SIR ROBERT LODER, Bart., Whittlebury, Towcester: the *Reserve Number* and *Highly Commended;* were dropped March 1st, 1886; bred by himself; sires, "Young Alderman" (1288), and "Lord Ripon" (2152); dam, by "Earl of Leicester" (171), and "Chesham 2nd" (362).

CLASS 145.—*Southdown Two-Shear Rams.*

1367 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: FIRST PRIZE, 15*l.*; was dropped in March, 1885; bred by himself.

1360 HUGH GORRINGE, Kingston-by-Sea, Brighton, Sussex: SECOND PRIZE, 10*l.*; was dropped in February, 1885; bred by himself.

1365 GEORGE CAREW CAREW-GIBSON, Sandgate, Pulborough, Sussex: THIRD PRIZE, 5*l.*; was dropped in March, 1885; bred by himself.

1362 HUGH GORRINGE, Kingston-on-Sea: the *Reserve Number* and *Highly Commended;* was dropped in February, 1885; bred by himself.

CLASS 146.—*Southdown Shearling Rams.*

1376 EDWIN ELLIS, Summersbury, Shalford, Guildford, Surrey: FIRST PRIZE, 15*l.*; was dropped about March, 1st, 1886; bred by himself; sire, "Merton"; dam, "Botting Ewe," by Colman's "No. 3."

1386 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: SECOND PRIZE, 10*l.*; was dropped in March, 1886; bred by himself.

1368 H.R.H. THE PRINCE OF WALES, K.G., Sandringham: THIRD PRIZE, 5*l.*; was dropped March 1st, 1886; bred by His Royal Highness.

1375 EDWIN ELLIS, Summersbury: the *Reserve Number* and *Highly Commended;* was dropped March 10th, 1886; bred by himself; sire, "Merton"; dam, "Throgmorton Ewe."

CLASS 147.—*Southdown Ram Lambs, dropped in the Year* 1887—*Pens of Three.*

1390 EDWIN ELLIS, Summersbury, Shalford: FIRST PRIZE, 10*l.*; were dropped about February 14th; bred by himself.

1389 H.R.H. THE PRINCE OF WALES, K.G., Sandringham: SECOND PRIZE, 5*l.*; were dropped in March; bred by His Royal Highness.

1394 GEORGE CAREW CAREW-GIBSON, Sandgate, Pulborough: the *Reserve Number;* were dropped in March; bred by himself.

CLASS 148.—*Southdown Shearling Ewes—Pens of Five.*

1401 JEREMIAH JAMES COLMAN, M.P., Norwich: FIRST PRIZE, 15*l.*; were dropped in March, 1886; bred by himself.

1398 EDWIN ELLIS, Summersbury, Shalford: SECOND PRIZE, 10*l.*; were dropped about March 20th, 1886; bred by himself; sires, "Ripon" and "Merton"; dams, "Botting Ewes."

1397 H.R.H. THE PRINCE OF WALES, K.G., Sandringham: the *Reserve Number* and *Highly Commended;* were dropped in March, 1886; bred by His Royal Highness.

CLASS 149.—*Hampshire Down Two-Shear Rams.*

1405 FRANK R. MOORE, Littlecott, Upavon, Marlborough, Wiltshire: FIRST PRIZE, 15*l.*; was dropped in January, 1885; bred by himself.

1408 HENRY LAMBERT, Babraham, Cambridge: SECOND PRIZE, 10*l.*: and
1409 the *Reserve Number* for 1409; were dropped about January 16th, 1885; both bred by himself.

CLASS 150.—*Hampshire Down Shearling Rams.*

1416 FRANK R. MOORE, Littlecott, Upavon: FIRST PRIZE, 15*l.*; was dropped in January, 1886; bred by himself.

1424 HENRY LAMBERT, Babraham, Cambridge: SECOND PRIZE, 10*l.*; was dropped about January 16th, 1886; bred by himself.

1422 HENRY PERRY-KEENE, Rowfant, Crawley, Sussex: THIRD PRIZE, 5*l.*; was dropped February 1st, 1886; bred by himself.

1423 HENRY LAMBERT: the *Reserve Number* and *Highly Commended;* was dropped about January 16th, 1886; bred by himself.

Class 151.—*Hampshire Down Ram Lambs, dropped in the Year 1887—Pens of Three.*

1431 Frank R. Moore, Littlecott, Upavon: First Prize, 10*l.*; were dropped in January; bred by himself.

1436 Henry Lambert, Babraham, Cambridge: Second Prize, 5*l.*; were dropped about January 16th; bred by himself.

1437 Henry Perry-Keene, Rowfant, Crawley: the *Reserve Number* and *Highly Commended*; were dropped about February 1st; bred by himself.

Class 152.—*Hampshire Down Shearling Ewes—Pens of Five.*

1446 Henry Perry-Keene, Rowfant, Crawley: First Prize, 15*l.*; were dropped about February 1st, 1886; bred by himself.

1444 The College of Agriculture, Downton, Braemore, Hampshire: Second Prize, 10*l.*; were dropped on January 20th, 1886; bred by Professor Wrightson.

Class 153.—*Suffolk Two-Shear Rams.*

1447 The Marquess of Bristol, Ickworth Park, Bury St. Edmunds: First Prize, 15*l.*, for "Van Tromp 2nd"; was dropped in January, 1885; bred by himself; sire, "Van Tromp 1st" (290).

1449 George Bentinck Robins, Moulton, Newmarket: Second Prize, 10*l.*, for "Royal Jumbo" (237); was dropped February 1st, 1885; bred by himself.

1450 Joseph Smith, Thorpe Hall, Hasketon, Woodbridge: the *Reserve Number* and *Highly Commended* for "Jumbo 3rd" (140); was dropped in February, 1885; bred by himself; sire, "Jumbo."

Class 154.—*Suffolk Shearling Rams.*

1455 Joseph Smith, Thorpe Hall, Hasketon: First Prize, 15*l.*, for "Norwich" (176); was dropped in February, 1886; bred by himself.

1452 The Marquess of Bristol, Ickworth Park, Bury St. Edmunds: Second Prize, 10*l.*, for "Van Tromp 3rd"; was dropped in January, 1886; bred by himself; sire, "Van Tromp 1st" (290).

1454 George Bentinck Robins, Moulton, Newmarket: the *Reserve Number* and *Highly Commended* for "Overlooked" (193); was dropped February 3rd, 1886; bred by himself.

Class 155.—*Suffolk Ram Lambs, dropped in the Year 1887—Pens of Three.*

1457 The Marquess of Bristol, Ickworth Park, Bury St. Edmunds: First Prize, 10*l.*; were dropped after January 14th; bred by himself; sire, "Van Tromp 2nd," and "Van Tromp 3rd."

1461 George Bentinck Robins, Moulton, Newmarket: Second Prize, 5*l.*; were dropped on February 3rd and 4th; bred by himself; sires, "Royal Jumbo" (237), "Jumper" (142), and "Lidgate II." (152).

1462 RICHARD JOHN MARSH, Lordship Farm, Newmarket: the *Reserve Number* and *Highly Commended;* were dropped in the second week of January; bred by himself.

CLASS 156.—*Suffolk Shearling Ewes—Pens of Five.*

1466 THE MARQUESS OF BRISTOL, Ickworth Park, Bury St. Edmunds: FIRST PRIZE, 15*l.*; were dropped in January, 1886; bred by himself; sires, "Van Tromp 1st" and "Van Tromp 2nd."

1467 JOSEPH SMITH, Thorpe Hall, Hasketon: SECOND PRIZE, 10*l.*; were dropped in February, 1886; bred by himself.

CLASS 157.—*Border Leicester Rams, Two-Shear and upwards.**

1469 THE RIGHT HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk, East Lothian: FIRST PRIZE, 15*l.*; bred by himself.

1473 GEORGE BIRKETT, Town Foot Farm, Brampton, Cumberland: SECOND PRIZE, 10*l.*; was dropped in 1885; bred by the Right Hon. A. J. Balfour, M.P., Whittinghame, N.B.

1472 GEORGE SIMSON, Courhill, Kelso, Berwickshire: THIRD PRIZE, 5*l.*; was dropped in March, 1884; bred by himself.

1475 THOMAS HUTCHINSON, Bambro' Hall, Belford, Northumberland: the *Reserve Number* for "General Forster"; was dropped March 1st, 1884; bred by Mr. J. Hutchinson, the College, Durham.

CLASS 158.—*Border Leicester Shearling Rams.**

1488 THOMAS CLARK, Oldhamstocks Mains, Cockburnspath, Haddingtonshire: FIRST PRIZE, 15*l.*; was dropped February 11th, 1886; bred by himself.

1478 THE RIGHT HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk: SECOND PRIZE, 10*l.*; bred by himself.

1482 ALEXANDER RUSSELL MELVIN, Bonnington, Wilkieston, Mid-Lothian: THIRD PRIZE, 5*l.*; was dropped in March, 1886; bred by himself.

1490 THOMAS CLARK, Oldhamstocks Mains: the *Reserve Number;* was dropped March 5th, 1886; bred by himself.

CLASS 159.—*Border Leicester Ewes, Two-Shear and upwards, that have reared Lambs during the Year* 1887*—Pens of Five.**

1503 GEORGE SIMSON, Courthill, Kelso: FIRST PRIZE, 15*l.*; were dropped in March, 1883; bred by himself.

1504 LORDS ARTHUR and LIONEL CECIL, Orchardmains, Innerleithen, Peeblesshire: SECOND PRIZE, 10*l.*; bred by themselves.

CLASS 160.—*Border Leicester Shearling Ewes—Pens of Five.**

1505 THE RIGHT HON. A. J. BALFOUR, M.P., Whittinghame, Prestonkirk: FIRST PRIZE, 15*l.*; bred by himself.

1509 THOMAS CLARK, Oldhamstocks Mains, Cockburnspath: SECOND PRIZE, 10*l.*; were dropped from March 5th to April 1st; bred by himself.

1508 ALEXANDER RUSSELL MELVIN, Donnington, Lothian: THIRD PRIZE, 5*l.*; were dropped in March, 1886; bred by himself.

1512 JOHN TWENTYMAN, Hawkrigg House, Wigton, Cumberland: the *Reserve Number* and *Highly Commended*; were dropped in April, 1886; bred by himself.

CLASS 161.—*Cheviot Rams, Two-Shear and upwards.* †*

1519 JOHN ROBSON, Newton, Bellingham, Northumberland: FIRST PRIZE, 15*l.*,
1522 was dropped in April, 1884: and SECOND PRIZE, 10*l.*, for 1522; was dropped in April, 1885; both bred by himself.

1517 JACOB ROBSON, of Byrness, Otterburn, Northumberland: THIRD PRIZE, 5*l.*; was dropped in April, 1885; bred by himself; sire, "Sprightly."

1520 JOHN ROBSON, Newton: the *Reserve Number* and *Highly Commended*; wa dropped in April, 1885; bred by himself.

CLASS 162.—*Cheviot Shearling Rams.* †*

1540 JOHN ROBSON, Newton, Bellingham: FIRST PRIZE, 15*l.*; SECOND PRIZE,
1539 10*l.*, for 1539; THIRD PRIZE, 5*l.*, for 1538; and the *Reserve Number* and
1538 *Highly Commended* for 1537; were dropped in April, 1886; all
1537 bred by himself.

CLASS 163.—*Cheviot Ewes, Two-Shear and upwards, that have reared Lambs during the Year* 1887—*Pens of Five.**

1550 JOHN ROBSON, Newton, Bellingham: FIRST PRIZE, 15*l.*; were dropped in April, 1881, 1884, and 1885; bred by himself.

1548 JACOB ROBSON, Byrness, Otterburn: SECOND PRIZE, 10*l.*; were dropped in April, 1884 and 1885; bred by himself.

1552 MICHAEL WRIGHT, Charlton, Bellingham, Northumberland: the *Reserve Number*; were dropped in 1882, 1883, and 1884; bred by himself.

CLASS 164.—*Cheviot Shearling Ewes—Pens of Five.**

1555 JOHN ROBSON, Newton, Bellingham: FIRST PRIZE, 15*l.*; were dropped in April, 1886; bred by himself.

1554 JACOB ROBSON, Byrness, Otterburn: SECOND PRIZE, 10*l.*; were dropped in March and April, 1886; bred by himself.

1557 ROBERT WATSON LAIDLAY, Halls, Dunbar, Haddingtonshire: THIRD PRIZE, 5*l.*; were dropped in April, 1886; bred by himself.

1553 DAVID HALL, Ingram, Alnwick, Northumberland: the *Reserve Number*; were dropped about April 15th, 1886; bred by himself.

CLASS 165.—*Black-faced Mountain Rams, Two-Shear and upwards.**

1563 JOHN ARCHIBALD, Overshiels, Stow, Mid-Lothian: FIRST PRIZE, 15*l.*; was dropped in April, 1885; bred by himself.

1559 WILLIAM MCCRACKEN, Greenleighton, Cambo, R.S.O., Northumberland: SECOND PRIZE, 10*l.*, for "Young Laird"; was dropped March 29th, 1884; bred by himself; sire, "Laird"; dam, "Wishan," by "Young Ayr."

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† Towards the Cheviot Prizes in Classes 161 and 162 45*l.* was subscribed by the Coquetdale Agricultural Society.

1565 JOHN ARCHIBALD, Overshiels: THIRD PRIZE, 5*l.*; was dropped in April, 1885; bred by himself.

1560 WILLIAM McCRACKEN, Greenleighton: the *Reserve Number* for "Young Prince"; was dropped April 3rd, 1884; bred by himself; sire, "Prince of Wales"; dam, "Young Ayr."

CLASS 166.—*Black-faced Mountain Shearling Rams.** †

1575 WILLIAM McCRACKEN, Greenleighton, Cambs, R.S.O.: FIRST PRIZE, 15*l.*, for "Cirencester"; was dropped April 6th, 1886; bred by himself; sire, "Young Laird"; dam, "Heather Belle," by "Prince of Wales."

1578 JOHN ARCHIBALD, Overshiels, Stow: SECOND PRIZE, 10*l.*; was dropped in April, 1886; bred by himself.

1576 WILLIAM McCRACKEN, Greenleighton: THIRD PRIZE, 5*l.*, for "Lave-
1573 rock"; was dropped April 9th, 1886: and the *Reserve Number* for 1573, "Ottercaps"; was dropped March 27th, 1886; both bred by himself.

CLASS 167.—*Black-faced Mountain Ewes, Two-Shear and upwards, that have reared Lambs during the Year* 1887—*Pens of Five.**

1587 ROBERT RAWLINSON, Docker Hall, Kendal, Westmoreland: FIRST PRIZE, 15*l.*; were dropped in March and April, 1884 and 1885; bred by himself; sire, "Norman"; dam, by "Prince Charlie."

1586 JOHN ROBSON, Newton, Bellingham, Northumberland: SECOND PRIZE, 10*l.*; were dropped in 1884 and 1885; bred by himself.

CLASS 168.—*Black-faced Mountain Ewes.—Pens of Five.**

1590 ROBERT RAWLINSON, Docker Hall, Kendal: FIRST PRIZE, 15*l.*; were dropped in April, 1886; bred by himself; sire, "Old Gimmer's Son"; dams, by "Norman."

1589 THOMAS ARMSTRONG, Ashgill Side, Alston, Cumberland: SECOND PRIZE, 10*l.*; were dropped April 15th, 1886; bred by himself.

CLASS 169.—*Herdwick Rams, Two-Shear and upwards.**

1594 GEORGE BROWNE, Drummlemire, Troutbeck, Windermere: FIRST PRIZE, 10*l.*, for "Scawfell"; was dropped about the middle of April, 1884; bred by himself.

1592 JAMES SPENCER, Murrah Hall, Penrith, Cumberland: SECOND PRIZE, 5*l.*, for "Disraeli"; was dropped April 23rd, 1883; bred by himself.

1598 JOHN ROTHERY, Eskin Farm, Wythop, Cockermouth, Cumberland: the *Reserve Number* and *Highly Commended* for "Just in Time"; was dropped in April, 1884; bred by himself; sire, "Blue Toppin"; dam, by "Yeoman."

CLASS 170.—*Herdwick Shearling Rams.**

1600 THE REPRESENTATIVES of the late HUGH PARKER HOLME, Chapel Hill, Mardale, Haweswater, Westmoreland: FIRST PRIZE, 10*l.*, for "Mountain Dew"; was dropped in April, 1886; bred by themselves; sire, "Borrowdale Jwohnny"; dam, "Sparkling Dew," by "Gladstone"; g. d., "Dew Drop."

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† Towards the Black-faced Mountain Prizes in Class 166, 30*l.* was subscribed by the Coquetdale Agricultural Society.

1602 GEORGE BROWNE, Drummlemire, Troutbeck: SECOND PRIZE, 5*l.*, for "Young Hero"; was dropped April 12th, 1886; bred by himself; sire, "Scawfell."

1604 HENRY CHARLES HOWARD, Greystoke Castle, Penrith: the *Reserve Number* and *Highly Commended*; was dropped about April 15th, 1886; bred by himself.

CLASS 171.—*Herdwick Ewes, Two-Shear and upwards, that have reared Lambs during the Year* 1887—*Pens of Five.**

1608 THE REPRESENTATIVES of the late HUGH PARKER HOLME, Chapel Hill, Mardale, Haweswater: FIRST PRIZE, 10*l.*; ages various; bred by the late H. P. Holme.

1609 HENRY CHARLES HOWARD, Greystoke Castle, Penrith: SECOND PRIZE, 5*l.*; were dropped in April, 1881–1885; bred by himself.

1607 JAMES SPENCER, Murrah Hall, Penrith: the *Reserve Number*; were dropped in 1881, 1882, and 1884; bred by himself.

CLASS 172.—*Herdwick Shearling Ewes—Pens of Five.**

1611 JAMES SPENCER, Murrah Hall, Penrith: FIRST PRIZE, 10*l.*; were dropped in 1886; bred by himself.

1612 THE REPRESENTATIVES of the late HUGH PARKER HOLME, Chapel Hill, Mardale, Haweswater: SECOND PRIZE, 5*l.*; were dropped in April, 1886; bred by themselves; sire, "Borrowdale Jwohnny."

1613 HENRY CHARLES HOWARD, Greystoke Castle, Penrith: the *Reserve Number* and *Highly Commended*; were dropped in April, 1886; bred by himself.

CLASS 173.—*Lonk Rams, Two-Shear and upwards.**

1616 MESSRS. DEARDEN and BLACKBURN, Reedyford, Nelson-in-Marsden, Lancashire: FIRST PRIZE, 10*l.*; was dropped March 20th, 1885; bred by Mr. J. Ormored, 6, Gorple Road, Worsthorne, Lancashire.

1615 JOSHUA ROBERT JENNINGS, Broom House, Keighley, Yorkshire: SECOND PRIZE, 5*l.*; was dropped in March, 1885; bred by Mr. Deardon, Nelson, Lancashire.

1617 WILLIAM WALSH, Gilstead, Bingley, Yorkshire: the *Reserve Number*; was dropped in March, 1885; bred by himself.

CLASS 174.—*Lonk Shearling Rams.**

1620 MESSRS. DEARDEN and BLACKBURN, Reedyford, Nelson-in-Marsden: FIRST PRIZE, 10*l.*; was dropped March 27th, 1886; bred by Mr. Birtwistle, Birkett, Clitheroe, Lancashire.

1618 MRS. DAWSON, Weston Hall, Otley, Yorkshire: SECOND PRIZE, 5*l.*, for "Jumbo"; was dropped in April, 1886; bred by Mr. G. Smith, Lowfield House, Keighley, Yorkshire.

1619 MESSRS. DEARDEN and BLACKBURN, Reedyford: the *Reserve Number* and *Highly Commended*; was dropped March 17th, 1886; bred by themselves.

CLASS 175.—*Lonk Shearling Ewes—Pens of Five.**

1622 WILLIAM WALSH, Gilstead, Bingley: FIRST PRIZE, 10*l.*; were dropped in February, 1886; bred by Mr. J. Clarkson, Silsden, Leeds.

1621 JOSHUA ROBERT JENNINGS, Broom House, Keighley: SECOND PRIZE, 5*l.*; were dropped in March, 1886; bred by himself and others.

1623 WILLIAM WALSH, Gilstead: the *Reserve Number* and *Highly Commended*; were dropped in February, 1886; bred by himself.

CLASS 176.—*Other Short-woolled Two-Shear Rams.*

1624 FRANK SHEPHERD, The Brook, Colwall, Malvern: FIRST PRIZE, 10*l.*, for his Ryeland; was dropped March 10th, 1885; bred by himself.

CLASS 177.—*Other Short-woolled Shearling Rams.*

1627 FRANK SHEPHERD, The Brook, Colwall: FIRST PRIZE, 10*l.*, for his Ryeland; was dropped March 20th, 1886; bred by himself.

CLASS 178.—*Other Short-woolled Shearling Ewes—Pens of Five.*

1630 SAMUEL KIDNER, Bickley Farm, Milverton, Somersetshire: FIRST PRIZE, 10*l.*, for his Dorset Horn; were dropped in December, 1885; bred by himself.

PIGS.

CLASS 179.—*Large White Breed—Boars, farrowed in the Year* 1886.

1639 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE,
1637 10*l.*, for "Worsley General 6th" (573): SECOND PRIZE, 5*l.*, for 1637,
1638 "Worsley General 8th" (577): and the *Reserve Number* for 1638, "Worsley General 7th" (575); were farrowed February 26th; all bred by himself; sire, "Worsley General 1st" (553); dam, "Cleopatra 8th" (348), by "King David" (103).

CLASS 180.—*Large White Breed—Boar Pigs, farrowed in the Year* 1887—*Pens of Three.*

1653 F. A. WALKER-JONES, Little Mollington, Chester: FIRST PRIZE, 10*l.*; were farrowed January 12th; bred by himself; sire, "Lord Derry"; dam, "True."

1650 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*; were farrowed January 7th; sire, "Worsley General 4th" (569); dam,
1651 by "Joseph 4th" (101): THIRD PRIZE, 3*l.*, for 1651; were farrowed January 6th; sire, "Worsley General 2nd" (565); dam, "Lancashire
1652 Witch" (752), by "Brutus" (65): and the *Reserve Number* for 1652; were farrowed January 2nd; sire, "Worsley General 1st" (563); dam, "Lancashire Lass 1st" (742), by "Samson" (79); all bred by himself.

CLASS 181.—*Large White Breed—Breeding Sows, farrowed previously to or in the Year* 1886.

1668 THE HON. MRS. MEYNELL INGRAM, Temple Newsam, Leeds: FIRST PRIZE, 10*l.*, for "Lady Shrewsbury"; was farrowed March 20th, 1884; bred by Mr. W. Beal, Lowthorpe, Hull.

1665 F. A. WALKER-JONES, Little Mollington, Chester: SECOND PRIZE, 5*l.*, for "Miss Hough" (416); was farrowed July 13th, 1883; bred by himself; sire, "Peter"; dam, "Miss Ashnall."

1670 PHILIP ASCROFT, Rufford, Ormskirk, Lancashire: THIRD PRIZE, 3*l.*, for "Sarah 2nd" (460); was farrowed November 15th, 1884; bred by himself; sire, "Ben" (59); dam, "Sarah" (168), by "Young Ranger."

1669 JAMES HOWARD, Clapham Park, Bedfordshire: the *Reserve Number* and *Highly Commended* for "Beauty 9th"; was farrowed October 30th, 1884; in-pig; bred by himself; sire, "Broadhead"; dam, "Beauty 5th," by "Hector."

CLASS 182.—*Large White Breed—Breeding Sow Pigs, farrowed in the Year* 1887—*Pens of Three.*

1679 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; were farrowed January 7th; sire, "Worsley General 4th" (569);
1680 dam, by "Joseph 4th" (101): and SECOND PRIZE, 5*l.*, for 1680; were farrowed January 5th; sire, "Worsley General 4th" (569); dam, "Worsley Milkmaid 2nd" (850), by "Cultivator XXX." (487); all bred by himself.

1677 F. A. WALKER-JONES, Little Mollington, Chester: THIRD PRIZE, 3*l.*; were farrowed January 12th; bred by himself; sire, "Lord Derry"; dam, "True."

1681 THE EARL OF ELLESMERE, Worsley Hall: the *Reserve Number* and *Highly Commended;* were farrowed January 6th; bred by himself; sire, "Worsley General 2nd" (565); dam, "Lancashire Witch" (752), by "Brutus" (65).

CLASS 183.—*Middle White Breed—Boars farrowed in the Year* 1886.

1694 THOMAS COLLINSON, Shay Farm, Halifax, Yorkshire: FIRST PRIZE, 10*l.*, for "Silver King"; was farrowed March 31st; bred by himself; sire, "Silver Crown"; dam, "Kitty."

1693 JOHN CARTER AND SONS, Northgate, Bradford, Yorkshire: SECOND PRIZE, 5*l.*; was farrowed January 20th; bred by themselves.

1688 THE EARL OF ELLESMERE, Worsley Hall, Manchester: THIRD PRIZE, 3*l.*, for "Worsley Ronald 2nd"; was farrowed June 6th; sire, "Worsley Ronald" (611); dam, "Worsley Princess 2nd" (936), by "Peter"
1689 (183): and the *Reserve Number* and *Highly Commended* for 1689, "Worsley King 3rd"; was farrowed February 20th; sire, "Worsley King" (607); dam, "Worsley Princess" (934), by "Peter" (183); both bred by himself.

CLASS 184.—*Middle White Breed—Boar Pigs, farrowed in the Year* 1887—*Pens of Three.*

1699 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; were farrowed January 3rd; sire, "King William" (593); dam, "Worsley Princess 2nd" (936), by "Peter" (183): and SECOND PRIZE, 5*l.*; for
1700 1700; were farrowed January 2nd; sire, "King William" (593); dam, "Lady Worsley" (892), by "Peter" (183); all bred by himself.

1701 PHILIP ASCROFT, Rufford, Ormskirk: the *Reserve Number;* were farrowed January 7th; bred by himself; sire, "Peter" (185); dam, "Lilly," by "Luck."

CLASS 185.—*Middle White Breed—Breeding Sows farrowed previously to or in the Year* 1886.

1714 PHILIP ASCROFT, Rufford, Ormskirk: FIRST PRIZE, 10*l.*, for "Lucy"; was farrowed December 26th, 1882; bred by Mr. G. Lewis, Ercall Park, Wellington, Salop.

1707 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*, for "Worsley Princess 4th"; was farrowed December 1st, 1884; bred by himself; sire, "Peter" (183); dam, by "Prince" (187).

1713 PHILIP ASCROFT, Rufford: THIRD PRIZE, 3*l.*, for "Lilly"; was farrowed January 27th, 1884; bred by himself; sire, "Luck"; dam, "Gyp" (212), by "Old Bill."

1708 THE HON. MRS. MEYNELL INGRAM, Temple Newsam, Leeds: the *Reserve Number* and *Highly Commended* for "Silverhair"; was farrowed November 1st, 1883; bred by Mr. F. Walker-Jones.

CLASS 186.—*Middle White Breed—Breeding Sow Pigs, farrowed in the Year* 1887—*Pens of Three.*

1719 JOHN CARTER AND SONS, Northgate, Bradford: FIRST PRIZE, 10*l.*; were farrowed in February; bred by themselves; sire, "Pride of Bradford."

1716 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*; were farrowed January 3rd; bred by himself; sire, "King William" (593); dam, by "Peter" (183).

1717 F. A. WALKER-JONES, Little Mollington, Chester: THIRD PRIZE, 3*l.*, were farrowed January 10th; bred by himself; sire, "Sailor."

1721 TOM STRICKLAND, Thirsk Junction, Thirsk, Yorkshire: the *Reserve Number;* were farrowed February 2nd; bred by himself.

CLASS 187.—*Small White Breed—Boars farrowed in the Year* 1886.

1723 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*, for "Worsley Dandy 3rd"; was farrowed January 26th; bred by himself; sire, "The Swell" (249); dam, "Worsley Belle 1st" (988), by "The
1724 Swell" (249): and SECOND PRIZE, 5*l.*, for 1724, "Forrester"; was farrowed May 30th; bred by Mr. Oldroyd, Newsam Green, Leeds; sire, "Little John"; dam, by "Hero 2nd."

1726 THE EARL OF RADNOR, Coleshill House, Highworth, Wiltshire: the *Reserve Number*; was farrowed August 20th; bred by himself; sire, "Lord Derby"; dam, "Coleshill," by "Warwick."

CLASS 188.—*Small White Breed—Boar Pigs, farrowed in the Year* 1887—*Pens of Three.*

1729 THE EARL OF RADNOR, Coleshill House, Highworth: FIRST PRIZE, 10*l.*; were farrowed January 5th; bred by himself; sire, "Jumbo"; dam, "Duchess," by "Coxwell."

CLASS 189.—*Small White Breed—Breeding Sows, farrowed previously to or in the Year* 1886.

1732 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*, for "Worsley Beauty" (986); was farrowed April 3rd, 1885; bred by himself; sire, "The Swell" (249); dam, by "The Swell" (249).

1734 F. A. Walker-Jones, Little Mollington, Chester: Second Prize, 5*l.*; was farrowed November 21st, 1884; bred by himself; sire, "Roger"; dam, "Snowdrop" (264), by "Curly."

1735 The Earl of Radnor, Coleshill House, Highworth: Third Prize, 3*l.*; was farrowed April 23rd, 1886; in-pig; bred by himself; sire, "Jumbo"; dam, "Shrewsbury 2nd," by "Gentleman."

1733 The Earl of Ellesmere, Worsley Hall: the *Reserve Number* and *Highly Commended* for "Worsley Belle 4th"; was farrowed January 26th, 1886; in-pig; bred by himself; sire, "The Swell" (249); dam, "Worsley Belle 1st" (988), by "The Swell" (249).

Class 190.—*Small White Breed—Breeding Sow Pigs, farrowed in the Year* 1887*—Pens of Three.*

1746 The Earl of Radnor, Coleshill House, Highworth: First Prize, 10*l.*; were farrowed January 3rd; bred by himself; sire, "Jumbo"; dam, "Lady Edith," by "Lord Derby."

1744 F. A. Walker-Jones, Little Mollington, Chester: Second Prize, 5*l.*; were farrowed January 22nd; bred by himself; sire, "Roger 2nd"; dam, "Snowdrop 2nd."

1745 The Earl of Radnor, Coleshill House: the *Reserve Number*; were farrowed January 6th; bred by himself; sire, "Peter"; dam, "Marchioness," by "Sir Garnett."

Class 191.—*Berkshire Breed—Boars, farrowed in the Year* 1886.

1747 The Executors of the late Arthur Stewart, Saintbridge Farm, Gloucester: First Prize, 10*l.*; was farrowed January 5th; bred by themselves; sire, "Challenge" (124); dam, "Busybody" (195), by "King Birt."

1749 Thomas Stephen Minton, Montford, Montford Bridge, R.S.O., Shropshire: Second Prize, 5*l.*, for "Pilot"; was farrowed July 6th; bred by himself; sire, "Speculation" (151); dam, "Sally Lunn III.," by "Lord Rayleigh."

1750 Arthur S. Gibson, Springhill, Bulwell, Notts: the *Reserve Number* and *Highly Commended* for "Goschen"; was farrowed May 4th; bred by himself; sire, "Pomp" (656); dam, "Worcester XIV." (663), by "Wizard V."

Class 192.—*Berkshire Breed—Boar Pigs, farrowed in the Year* 1887 *—Pens of Three.*

1760 Nathaniel Benjafield, Short's Green Farm, Motcombe, Shaftesbury, Dorset: First Prize, 10*l.*; were farrowed January 22nd; bred by himself; sire, "Warrener" (759); dam, "Agatha" (760), by "Beaconsfield" (324).

1757 Alfred E. W. Darby, Little Ness, Shrewsbury: Second Prize, 5*l.*; were farrowed January 11th; sire, "Lord Conyers" (122); dam, "Prescot Maid," by "Speculation" (151): and the *Reserve Number*
1756 and *Highly Commended* for 1756; were farrowed January 14th; sire, "Lord Conyers" (122); dam, "Baschurch Maid," by "Speculation" (151); all bred by himself.

CLASS 193.—*Berkshire Breed—Breeding Sows, farrowed previously to or in the Year* 1886.

1773 NATHANIEL BENJAFIELD, Short's Green Farm, Motcombe: FIRST PRIZE, 10*l.*, for "Blanche"; was farrowed June 11th, 1886; in-pig; bred by Mr. J. P. Andrews, Marnhull; sire, "Speculation"; dam, "Queen of the Isles," by "Bingley Lad II." (34).

1769 JOHN PITMAN KING, North Stoke, Wallingford, Berkshire: SECOND PRIZE, 5*l.*, for "Moulsford 44"; was farrowed September 7th, 1885; bred by himself; sire, "Sir Isaac" (225); dam, "Moulsford 31" (730), by "Watchman" (485).

1766 ALFRED E. W. DARBY, Little Ness, Shrewsbury: THIRD PRIZE, 3*l.*, for "Pomona"; was farrowed January 24th, 1886; in-pig; bred by himself; sire, "Royal Preston" (694); dam, "Pandora," by "Lord Conyers" (122).

1764 THE EXECUTORS OF THE LATE ARTHUR STEWART, Saintbridge Farm, Gloucester: the *Reserve Number;* was farrowed January 5th, 1886; in-pig; bred by themselves; sire, "Lady Kingscote 3rd" (194), by "Scothern."

CLASS 194.—*Berkshire Breed—Breeding Sow Pigs, farrowed in the Year* 1887—*Pens of Three.*

1782 NATHANIEL BENJAFIELD, Short's Green Farm, Motcombe: FIRST PRIZE, 10*l.*; were farrowed January 21st; bred by himself; sire, "Corp"; dam, "Rosebud III." (592), by "Bingley Lad II." (34).

1779 THE EXECUTORS OF THE LATE ARTHUR STEWART, Saintbridge Farm, Gloucester: SECOND PRIZE, 5*l.*; were farrowed January 4th; bred by themselves; sire, "Exor" (202); dam, "Lady Kingscote 3rd" (194), by "Scothern."

1780 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: the *Reserve Number* and *Highly Commended;* were farrowed January 13th; bred by the Duchess of Hamilton and Brandon, Great Glemham, Saxmundham, Suffolk; sire, "Sandstone"; dam, "Glemham Moulsford 15th."

CLASS 195.—*Any other Black Breed—Boars, farrowed in the Year* 1886.

1789 GEORGE PETTIT, The Firs, Friston, Saxmundham, Suffolk: FIRST PRIZE, 10*l.*, for "Hero" (Suffolk Black); was farrowed July 6th; bred by himself; sire, "Danger"; dam, "Lucy."

1787 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market: SECOND PRIZE, 5*l.*, for "William" (Small Black); was farrowed January 5th; bred by Rev. W. Hooper, Little Glemham, Wickham Market; sire, "Blackbird"; dam, "Black Duchess," by "Gipsy King."

1785 JOSEPH ALFRED SMITH, Rise Hall, Akenham, Ipswich, Suffolk: the *Reserve Number* for "Jubilee" (Suffolk Black); was farrowed August 2nd; bred by himself; sire, "Playford"; dam, "Elegance," by "Lord Essex."

CLASS 196.—*Any other Black Breed—Boar Pigs, farrowed in the Year* 1887—*Pens of Three.*

1791 GEORGE PETTIT, The Firs, Friston: FIRST PRIZE, 10*l.*, for his Suffolk Black; were farrowed February 1st; bred by himself; sire, "Dan er" dam, "Victoria."

1790 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market: SECOND PRIZE, 5*l.*, for his Small Black; were farrowed April 9th; bred by himself; sire, "Tommy"; dam, "Princess," by "Young Robert."

1792 JOSEPH ALFRED SMITH, Rise Hall, Akenham: the *Reserve Number* for his Suffolk Black; were farrowed May 1st; bred by himself; sire, "Shamrock"; dam, "Expectation" (52), by "Parnell" (45).

CLASS 197.—*Any other Black Breed—Breeding Sows farrowed previously to or in the Year* 1886.

1797 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham: FIRST PRIZE, 10*l.*, for "Black Duchess" (Small Black); was farrowed June 29th, 1885; bred by the Rev. W. Hooper, Little Glemham, Wickham Market; sire, "Gipsy King" (277); dam, "Lady Sutton," by
1798 "Lord Salisbury": and SECOND PRIZE, 5*l.*, for 1798, "Pride" (Small Black); was farrowed April 7th, 1886; in-pig; bred by himself; sire, "Tommy"; dam, "Princess," by "Robert the Devil."

1799 GEORGE PETTIT, The Firs, Friston: THIRD PRIZE, 5*l.*, for "Primrose" (Suffolk Black); was farrowed June 6th, 1886; in-pig; bred by himself; sire, "Danger"; dam, "Ann."

1800 JOSEPH ALFRED SMITH, Rise Hall, Akenham: the *Reserve Number* for "Dairymaid" (Suffolk Black); was farrowed February 27th, 1885; bred by himself; sire, "Lord Essex"; dam, "Faith's Daughter," by "Parnell" (45).

CLASS 198.—*Any other Black Breed—Breeding Sow Pigs, farrowed in the Year* 1887*—Pens of Three.*

1801 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market: FIRST PRIZE, 10*l.*, for his Small Black; were farrowed April 9th; bred by himself; sire, "Tommy"; dam, "Princess," by "Young Robert."

1802 GEORGE PETTIT, The Firs, Friston: SECOND PRIZE, 5*l.*, for his Suffolk Black; were farrowed January 10th; bred by himself; sire, "Gipsy King"; dam, "Ann."

1803 JOSEPH ALFRED SMITH, Rise Hall, Akenham: the *Reserve Number* for his Small Black; were farrowed May 1st; bred by himself; sire, "Shamrock"; dam, "Expectation" (52), by "Parnell" (45).

CLASS 199.—*Tamworth Breed—Boars, farrowed in the Year* 1886.

1805 THE AYLESBURY DAIRY COMPANY, Horsham, Sussex: FIRST PRIZE, 10*l.* for "Dick"; was farrowed January 20th; bred by themselves; sire, "Peeping Tom" (419); dam, "Lady Foster II." (560), by "The Peeler" (433).

1806 WILLIAM HENRY MITCHELL, Elmdene, Kenilworth, Warwickshire: SECOND PRIZE, 5*l.*, for "Saul"; was farrowed June 10th; bred by himself; sire, "Samuel"; dam, "Stoney."

1804 JOHN NORMAN, JUN., Cliff House, Tamworth, and JOSEPH NORMAN, Nether Whitacre, Coleshill, Warwickshire: the *Reserve Number* for "Royal Chief"; was farrowed January 17th; bred by Mr. John Norman, Jun.; sire, "William the Conqueror"; dam, "Duchess."

CLASS 200.—*Tamworth Breed—Boar Pigs, farrowed in the Year* 1887 *—Pens of Three.*

1808 JOHN NORMAN, JUN., Cliff House, and JOSEPH NORMAN, Nether Whitacre: FIRST PRIZE, 10*l.*; were farrowed January 2nd; bred by Mr. Joseph Norman; sire, "Curley"; dam, "Sally," by "Redskin."

1809 R. N. SUTTON-NELTHORPE, Scawby Hall, Brigg, Lincolnshire: SECOND PRIZE, 5*l.*; were farrowed January 12th; bred by himself.

1810 WILLIAM HENRY MITCHELL, Elmdene, Kenilworth, Warwickshire: the *Reserve Number;* were farrowed January 4th; bred by himself; sire, "Noble"; dam, "Silk," by "Samson."

CLASS 201.—*Tamworth Breed—Breeding Sows, farrowed previously to or in the Year* 1886.

1820 WILLIAM HENRY MITCHELL, Elmdene, Kenilworth: FIRST PRIZE, 10*l.*, for "Sylvia II."; was farrowed June 14th, 1884; in-pig; sire, "Samson";
1821 dam, "Sylvia": and SECOND PRIZE, 5*l.*, for 1821, "Sable"; was farrowed June 14th, 1885; sire, "Samson"; dam, "Sylvia"; both bred by himself.

1815 THE AYLESBURY DAIRY COMPANY, Horsham: THIRD PRIZE, 3*l.*, for "Lady Foster 2nd"; was farrowed August 8th, 1884; bred by Mr. G. M. Allender, Stammerham, Horsham; sire, "The Peeler" (433); dam, "Lady Foster" (558), by "St. Lubbock" (423): and the *Reserve*
1814 *Number* and *Highly Commended* for 1814, "Lady Preston 2nd"; was farrowed February 8th, 1885; in-pig; bred by Mr. G. M. Allender, Solna, Roehampton, Surrey; sire, "Sir Hugh" (431); dam, "Lady Godiva" (562).

CLASS 202.—*Tamworth Breed—Breeding Sow Pigs, farrowed in the Year* 1887*—Pens of Three.*

1822 JOHN NORMAN, JUN., Cliff House, and JOSEPH NORMAN, Nether Whitacre: FIRST PRIZE, 10*l.*; were farrowed January 6th; bred by Mr. John Norman, Jun., Cliff House; sire, "The Squire"; dam, "Duchess II.," by "William the Conqueror."

1823 WILLIAM HENRY MITCHELL, of Elmdene, Kenilworth: SECOND PRIZE, 5*l.*; were farrowed January 14th; sire, "Noble"; dam, "Saucy,"
1824 by "Samson": and the *Reserve Number* for 1824; were farrowed January 2nd; sire, "Samuel"; dam, "Giddy"; all bred by himself.

CHEESE.

CLASS 203.—*Three Cheddar, not less than* 50 *lbs. each, made in the Year* 1886.

5 JOHN HILLARD, Hook Farm, Stoke Trister, Wincanton, Somerset: FIRST PRIZE, 20*l.*

3 JACOB CANDY, Charminster, Dorchester: SECOND PRIZE, 10*l.*

7 ALFRED REYNOLDS, Milborne Port, Sherborne: THIRD PRIZE, 5*l.*

4 JOHN HILLARD: the *Reserve Number* and *Highly Commended.*

CLASS 204.—*Three Cheshire, not less than* 40 *lbs. each, made in the Year* 1886.

10 WILLIAM HOULBROOKE, Brooklands, Wettenhall, Winsford, Cheshire: FIRST PRIZE, 20*l.*

11 THOMAS HOULBROOKE, Calveley Farm, Tarporley, Cheshire: SECOND PRIZE, 10*l.*

16 GEORGE WALLEY, Bull's Green Farm, Stoke, Nantwich, Cheshire: THIRD PRIZE, 5*l.*

15 JOSEPH SIDDORN, Broxton, Chester: the *Reserve Number* and *Highly Commended.*

CLASS 205.—*Six Stilton, made in the Year* 1886.

24 HENRY MORRIS, Manor Farm, Saxelby, Melton Mowbray, Leicestershire: FIRST PRIZE, 20*l.*

17 CHARLES GODSON, Great Dalby, Melton Mowbray: SECOND PRIZE, 10*l.*

25 HENRY MORRIS: THIRD PRIZE, 5*l.*

23 JAMES MORLEY, Sysonby, Melton Mowbray: the *Reserve Number* and *Highly Commended.*

CLASS 206.—*Three Cotherstone or Wensleydale, made in the Year* 1886.

(No Award.)

CLASS 207.—*Three Cheeses of any other British make, not exceeding* 30 *lbs. each, made in the Year* 1886.

34 ALFRED REYNOLDS, Milborne Port, Sherborne: FIRST PRIZE, 10*l.*

31 JOHN HILLARD, Hook Farm, Stoke Trister: SECOND PRIZE, 5*l.*: and the *Reserve Number* and *Highly Commended,* for 30.

CLASS 208.—*Three English Soft Cheeses, made in the Year* 1887.

44 JAMES LONG, Graveley Manor, Stevenage: FIRST PRIZE, 10*l.*

48 JOHN VALENTINE, Dun Cow Dairy, Ludlow: SECOND PRIZE, 5*l.*

40 EDWIN BROUGH, Wyndyate, Scarborough: the *Reserve Number* and *Commended.*

BUTTER.

CLASS 209.—*Six Pounds of Fresh Butter, absolutely free from Salt.*

12 MARY DOBSON, Green's Burn, Lanercost, Brampton, Cumberland: FIRST PRIZE, 5*l.*

38 WILLIAM WINTER, Highberries, Carlisle: SECOND PRIZE, 3*l.*

13 GEORGE DODGE, Moat House, Steeple Claydon, Winslow, Bucks: THIRD PRIZE, 2*l.*

26 JANE ROBINSON, Low Doctor Pasture, Walsingham, Durham: FOURTH PRIZE, 1*l.*

29 JOHN SWAN, Stonefield, Lincoln: the *Reserve Number* and *Highly Commended.*

CLASS 210.—*Six Pounds of Fresh Butter, slightly Salted.*

45 EDWARD CARTER, Puckpool House, Ryde, Isle of Wight: FIRST PRIZE, 5*l.*

79 MRS. JACOB WILSON, Chillingham Barns, Belford, Northumberland: SECOND PRIZE, 3*l.*

81 WILLIAM WINTER, Highberries, Carlisle: THIRD PRIZE, 2*l.*

51 MARY DOBSON, Green's Burn, Lanercost: FOURTH PRIZE, 1*l.*

44 EDWARD CARTER, Puckpool House: the *Reserve Number* and *Highly Commended.*

CLASS 211.—*One Keg or other Package of Salt Butter, not less than* 14 *lbs. in weight.*

91 MARY DOBSON, Green's Burn, Lanercost, Brampton, Cumberland: FIRST PRIZE, 10*l.*

107 WILLIAM WINTER, Highberries, Carlisle: SECOND PRIZE, 5*l.*: and the *Reserve Number* and *Commended*, for 106.

HIVES, HONEY, &c.

Prizes given by the British Bee-Keepers' Association.

CLASS 212.—*Frame Hives for general use, with arrangements for Summer and Winter. Price, complete, not to exceed* 15*s.*, *unpainted.*

2 G. NEIGHBOUR AND SON, 149, Regent Street, London: FIRST PRIZE, 1*l.*

10 ABBOTT BROTHERS, Southall, Middlesex: SECOND PRIZE, 15*s.*

9 S. J. BALDWIN, The Apiary, Bromley, Kent: THIRD PRIZE, 10*s.*

CLASS 213.—*Storyfying Frame Hives, with arrangements for Summer and Winter use. Price not to exceed* 10*s.*, *unpainted.*

13 G. NEIGHBOUR AND SON: FIRST PRIZE, 1*l.*

21 J. DINES AND SON, 71, High Street, Maldon, Essex: SECOND PRIZE, 15*s.*

20 ABBOTT BROTHERS: THIRD PRIZE, 10*s.*

CLASS 214.—*Honey Extractors, with arrangements for reversing the sides of Combs.*

23 W. P. MEADOWS, Syston, Leicester: FIRST PRIZE, 15*s.*

31 ABBOTT BROTHERS: SECOND PRIZE, 10*s.*

CLASS 215.—*Two-Section Racks, containing sections complete, with Separators, &c.*

42 ABBOTT BROTHERS: FIRST PRIZE, 15*s.*

43 W. B. BAKER, Muskham, Newark: SECOND PRIZE, 10*s.*

38 TURNER AND SON, Radcliffe-on-Trent: THIRD PRIZE, 5*s.*

Class 216.—*Feeders for Slow Stimulating Feeding.*

44 W. P. Meadows: First Prize, 10*s.*
47 T. B. Blow, Welwyn, Herts: Second Prize, 5*s.*

Class 217.—*Feeders for Quick Autumn Feeding.*

52 G. Neighbour and Son: First Prize, 10*s.*
54 Abbott Brothers: Second Prize, 5*s.*

Class 218.—*Large Smokers, filled with Fuel.*

58 T. B. Blow: First Prize, 10*s.*
55 W. P. Meadows: Second Prize, 5*s.*

Class 219.—*Ordinary-sized Smokers, filled with Fuel.*

62 G. Neighbour and Son: First Prize, 10*s.*
61 W. Dixon, 5, Beckett Street, Leeds: Second Prize, 5*s.*

Class 220.—*Any other Appliance for Quieting Bees.*

71 W. B. Webster, Wokingham: First Prize, 10*s.*, for Fumigator.

Class 221.—*Samples of Worker Comb Foundation.*

79 Abbott Brothers: First Prize, 15*s.*
78 S. J. Baldwin: Second Prize, 10*s.*

Class 222.—*Useful Inventions introduced since* 1885.

[No Award.]

Class 223.—*Twelve Sections of Comb Honey,* 5¼ *by* 6¼ (*width optional*).

112 W. Woodley, World's End, Newbury: First Prize, 1*l.*
117 H. Beswick, Tibbenham, Long Stratton: Second Prize, 10*s.*
111 Miss M. L. Gayton, Much Hadham, Ware: Third Prize, 5*s.*

Class 224.—*Twelve Sections of Comb Honey,* 4¼ *by* 4¼ *by* 2.

139 W. B. Baker, Muskham, Newark: First Prize, 1*l.*
140 H. Beswick: Second Prize, 10*s.*
126 H. Wood, Paradise, Lichfield: Third Prize, 5*s.*

Class 225.—*Twelve Sections of Comb Honey,* 4¼ *by* 4¼ (*width optional*).

154 H. Beswick: First Prize, 1*l.*
146 Miss M. L. Gayton: Second Prize, 10*s.*
142 A. D. Woodley, 26, Donnington Road, Reading: Third Prize, 5*s.*

CLASS 226.—*Run or Extracted Honey, in Twenty-four 1-lb. jars.*

163 W. WOODLEY: FIRST PRIZE, 1*l*.

162 MISS M. L. GAYTON: SECOND PRIZE, 10*s*.

174 W. F. ASKEW, Cark, Carnforth: THIRD PRIZE, 5*s*.

CLASS 227.—*Run or Extracted Honey, in Twelve 2-lb. jars.*

180 MISS M. L. GAYTON: FIRST PRIZE, 1*l*.

184 W. C. BROWN, Appleby, Doncaster: SECOND PRIZE, 10*s*.

177 A. D. WOODLEY: THIRD PRIZE, 5*s*.

CLASS 228.—*The Best Exhibition of Honey, not less than 1 cwt.*

189 W. GULSTON, Debenham, Stonham: FIRST PRIZE, 30*s*.

POULTRY.

By "Cocks," "Hens," "Drakes," "Ducks," "Ganders," and "Geese," are meant birds hatched previous to January 1st, 1887. and by "Cockerels," "Pullets," "Young Drakes," "Ducklings," "Young Ganders," and "Goslings," are meant birds hatched in 1887, previous to June 1st.

FOWLS.

CLASS 1.—*Dark Brahma Cock and One Hen.*

8 J. TAYLOR, Alsager, Stoke-on-Trent: FIRST PRIZE, 3*l*.

10 ARTHUR E. WARD, Thorold Grove, Sale, Cheshire: SECOND PRIZE, 2*l*.

4 RECHAB HOLLAND, Brahma Lodge, Buckingham: THIRD PRIZE, 1*l*.

2 JOHN GILLIES, Edington Mills, Chirnside, Berwickshire: the *Reserve Number*.

CLASS 2.—*Dark Brahma Cockerel and One Pullet.*

17 HORACE LINGWOOD, Creeting, Needham Market, Suffolk: FIRST PRIZE, 3*l*.

13 RECHAB HOLLAND, Buckingham: SECOND PRIZE, 2*l*.

14 CHARLES DAVENPORT JONES, Bryn-y-mor, Hastings: THIRD PRIZE, 1*l*.:
15 and the *Reserve Number* and *Commended*, for 15.

CLASS 3.—*Light Brahma Cock and One Hen.*

25 T. R. SIDGWICK, Hovingham, York: FIRST PRIZE, 3*l*.

27 ARTHUR EDWARD WARD, Sale: SECOND PRIZE, 2*l*.

21 MRS. BOARDMAN, Thorn Leigh, Burton, Westmoreland: THIRD PRIZE, 1*l*.

Class 4.—*Light Brahma Cockerel and One Pullet.*

29 The Rev. Harold Burton, Fauls Vicarage, Whitchurch, Salop: First
30 Prize, 3*l.*: and Second Prize, 2*l.*, for 30.

34 Thomas Tweedy, Thirsk, Yorkshire: Third Prize, 1*l.*

33 T. R. Sidgwick, Hovingham: the *Reserve Number.*

Class 5.—*Cochin Cock and One Hen (any variety).*

37 George H. Proctor, Flass House, Durham: First Prize, 3*l.*: and
36 Second Prize, 2*l.*, for 36.

38 Arthur E. Ward, Sale: Third Prize, 1*l.*

35 Mrs. Boardman, Burton: the *Reserve Number.*

Class 6.—*Cochin Cockerel and One Pullet (any variety).*

39 Alfred E. W. Darby, Little Ness, Shrewsbury: First Prize, 3*l.*

40 Mrs. Goodall, The Priory, Melton Mowbray: Second Prize, 2*l.*

43 John Trohear, Rottington, Whitehaven, Cumberland: the *Reserve Number.*

Class 7.—*Langshan Cock and One Hen.*

48 Captain Herbert Terry, Stobhill, Morpeth, Northumberland: First Prize, 3*l.*

46 Henry M. Orme, Lutwick, Slinfold, Horsham, Sussex: Second Prize, 2*l.*

47 Richard John Pope, Woodside, Barcomb, Lewes, Sussex: Third Prize, 1*l.*

44 Major Dent, Ainderby Hall, Northallerton, Yorkshire: the *Reserve Number.*

Class 8.—*Langshan Cockerel and One Pullet.*

54 Richard J. Pope, Barcomb: First Prize, 3*l.*

53 Henry M. Orme, Slinfold: Second Prize, 2*l.*

50 Charles A. Abraham, Risby Rectory, Bury St. Edmund's: Third
51 Prize, 1*l.*: and the *Reserve Number* and *Commended*, for 51.

Class 9.—*Houdan Cock and One Hen.*

60 Philip H. Lee, Wem, Salop: First Prize, 3*l.*

59 William Keenleyside, Fourstones, Northumberland: Second Prize, 2*l.*

65 John T. Calvert, Keighley, Yorkshire: Third Prize, 1*l.*

63 Samuel W. Thomas, Glasfryn Villas, Cockett, Swansea: the *Reserve Number* and *Highly Commended.*

Class 10.—*Houdan Cockerel and One Pullet.*

67 Samuel W. Thomas, Cockett, Swansea: First Prize, 3*l.*

66 John T. Calvert: Second Prize, 2*l.*, and the *Reserve Number* to 65.

Class 11.—*Plymouth Rock Cock and One Hen.*

77 Robert Stacey, The Yews, Colchester, Essex: First Prize, 3*l.*

69 Robert Butterfield, Nafferton Hall, Hull: Second Prize, 2*l.*

78 Robert Stacey: Third Prize, 1*l.*

68 Robert Butterfield: the *Reserve Number* and *Highly Commended.*

Class 12.—*Plymouth Rock Cockerel and One Pullet.*

90 William Parker, Rigmaden Park, Kirkby Lonsdale, Westmoreland: First Prize, 3*l.*

87 John L. Holden, Simonstone, Padiham, Lancashire: Second Prize, 2*l.*

95 Robert Stainthorp, Nipe Howe, Hawker, Whitby, Yorkshire: Third Prize, 1*l.*

85 Charles E. Fawkes, Upton Park, Slough, Bucks: the *Reserve Number* and *Highly Commended.*

Class 13.—*Scotch Grey Cock and One Hen.*

97 Andrew W. Henderson, Maryfield, Bridge of Allan, N.B.: First Prize, 3*l.*

99. Andrew Mitchell, Barcheskie, Kirkcudbright: Second Prize, 2*l.*

101. Matthew Smith, Townhead Farm, Thornhill, Dumfriesshire: Third Prize, 1*l.*

100. Claud L. Ralston, Glamis, Forfarshire: the *Reserve Number* and *Highly Commended.*

Class 14.—*Scotch Grey Cockerel and One Pullet.*

103. Thomas Clarkson, Carluke, Lanarkshire: First Prize, 3*l.*

107. Matthew Smith, Thornhill: Second Prize, 2*l.*

106. Claud L. Ralston, Glamis: Third Prize, 1*l.*

105. Andrew W. Henderson, Maryfield: the *Reserve Number* and *Highly Commended.*

Class 15.—*Andalusian Cock and One Hen.*

109 Henry Abbot, Rookery Farm, Thuxton, Hingham, Norfolk: First Prize, 3*l.*

111 David Butterfield, 3, Laythorpe Terrace, East Morton, Bingley, Yorks: Second Prize, 2*l.*

114 Mrs. W. Leighton, Bridge Street, Preston: Third Prize, 1*l.*

Class 16.—*Andalusian Cockerel and One Pullet.*

126 Edwin Merrall, Manor Heath, Morton, Bingley: First Prize, 3*l.*

118 The Rev. Ernest R. O. Bridgeman, Blymhill Rectory, Shifnal: Second Prize, 2*l.*

117 Henry Abbot, Thuxton: Third Prize, 1*l.*

Class 17.—*Minorca Cock and One Hen.*

131 William Cannan, Norwood, Crosshills, Leeds: First Prize, 3*l.*

138 William Snell, Jun., 129, High Street, Crediton, Devon: Second Prize, 2*l.*

133 S. FRIEND, 23, West Street, Tavistock, Devon: THIRD PRIZE, 1*l.*

137 JOB RAWNSLEY, Langley Farm, Bingley: the *Reserve Number* and *Highly Commended.*

CLASS 18.—*Minorca Cockerel and One Pullet.*

143 S. FRIEND, Tavistock: FIRST PRIZE, 3*l.*

147 WILLIAM PETER, The Castle, Exeter: SECOND PRIZE, 2*l.*

141 HENRY ABBOT, Thuxton: THIRD PRIZE, 1*l.*

148 WILLIAM SNELL, JUN., Crediton: the *Reserve Number* and *Highly Commended.*

CLASS 19.—*Black Hamburg Cock and One Hen.*

155 HENRY PICKLES, Rayfield House, Earby, Leeds: FIRST PRIZE, 3*l.*

152 JOSEPH LANCASTER, Alston, Cumberland: SECOND PRIZE, 2*l.*

151 WILLIAM CANNAN, Crosshills: THIRD PRIZE, 1*l.*

154 EDWIN MERRALL, Manor Heath, Morton, Bingley: the *Reserve Number* and *Highly Commended.*

CLASS 20.—*Black Hamburg Cockerel and One Pullet.*

161 EDWIN MERRALL, Morton: FIRST PRIZE, 3*l.*

160 WILLIAM H. FOX, Carter Royd House, Steeton, Leeds: SECOND PRIZE, 2*l.*

162 HENRY PICKLES, Earby: THIRD PRIZE, 1*l.*

159 WILLIAM CANNAN, Crosshills: the *Reserve Number* and *Highly Commended.*

CLASS 21.—*Any other variety—Hamburg Cock and One Hen.*

170 JOB RAWNSLEY, Bingley: FIRST PRIZE, 3*l.*

172 THOMAS TWEEDY, Thirsk, Yorkshire: SECOND PRIZE, 2*l.*

166 WILLIAM CANNAN, Crosshills: THIRD PRIZE, 1*l.*

169 HENRY PICKLES, Earby: the *Reserve Number* and *Highly Commended.*

CLASS 22.—*Any other variety—Hamburg Cockerel and One Pullet.*

179 HENRY PICKLES, Earby: FIRST PRIZE, 3*l.*

180 JOB RAWNSLEY, Bingley: SECOND PRIZE, 2*l.*

183 THOMAS TWEEDY, Thirsk: THIRD PRIZE, 1*l.*

175 WILLIAM CANNAN, Crosshills: the *Reserve Number* and *Highly Commended.*

CLASS 23.—*Leghorn Cock and One Hen.*

191 JOSEPH PRIDE, Thorverton, Cullompton, Devon: FIRST PRIZE, 3*l.*

189 JOHN HURST, South Terrace, Glossop, Derbyshire: SECOND PRIZE, 2*l.*

184 ROBERT ANTHONY, Lane House, Eastwood, Todmorden, Yorkshire: THIRD PRIZE, 1*l.*

190 JOHN HURST: the *Reserve Number* and *Highly Commended.*

CLASS 24.—*Leghorn Cockerel and One Pullet.*

193 JOHN BERRY, Aireview, Silsden, Leeds: FIRST PRIZE, 3*l.*

203 LOUIS C. VERREY, Oak Lawn, Leatherhead, Surrey: SECOND PRIZE, 2*l.*

202 WILLIAM LAUGHER, Point House, Exmouth, Devon: THIRD PRIZE, 1*l.*

196 ALBERT C. BRADBURY, Nuthall, Nottingham: the *Reserve Number* and *Highly Commended.*

CLASS 25.—*Coloured Dorking Cock and One Hen.*

217 BUTLER SMITH, The Grove, Cropwell Butler, Nottingham: FIRST PRIZE, 3*l.*

208 JAMES CRANSTON, Tinwald House, Dumfries, N.B.: SECOND PRIZE, 2*l.*:
209 and THIRD PRIZE, 1*l.*, for 209.

207 HENRY BRITTEN, Skirwith Abbey, Penrith, Cumberland: the *Reserve Number* and *Highly Commended.*

CLASS 26.—*Coloured Dorking Cockerel and One Pullet.*

218 HENRY BRITTEN, Penrith: FIRST PRIZE, 3*l.*

220 JAMES CRANSTON, Dumfries: SECOND PRIZE, 2*l.*

228A MISS MURRAY, Thulstone, Derby: THIRD PRIZE, 1*l.*

226 RICHARD SMALLEY, Lune Villa, Skerton, Lancaster: the *Reserve Number* and *Highly Commended.*

CLASS 27.—*Silver Grey Dorking Cock and One Hen.*

229 JAMES CRANSTON, Dumfries: FIRST PRIZE, 3*l.*: and SECOND PRIZE, 2*l.*,
230 for 230.

235 ARTHUR E. WARD, Thorold Grove, Sale, Cheshire: THIRD PRIZE, 1*l.*

231 FREDERICK MARSON, Tillington, Stafford: the *Reserve Number* and *Highly Commended.*

CLASS 28.—*Silver Grey Dorking Cockerel and One Pullet.*

238 FREDERIC MARSON, Tillington, Stafford: FIRST PRIZE, 3*l.*: and SECOND
239 PRIZE, 2*l.*, for 239.

243 WALTER VEITCH, JUN., Cemetery House, Carlisle: THIRD PRIZE, 1*l.*: and
242 the *Reserve Number* and *Highly Commended*, for 242.

CLASS 29.—*Any other variety—Dorking Cock and One Hen.*

244 ALFRED E. W. DARBY, Little Ness, Shrewsbury: FIRST PRIZE, 3*l.*

247 JOSEPH PETTIPHER, Woodway House, Sibford, Banbury: SECOND PRIZE, 2*l.*

248 PETER WILSON, Colvinston, Annbank, Ayrshire: THIRD PRIZE, 1*l.*

245 ALFRED E. W. DARBY: the *Reserve Number* and *Highly Commended.*

CLASS 30.—*Any other variety—Dorking Cockerel and One Pullet.*

251 CHARLES A. GOSNELL, Bridge House, Feltham, Middlesex: FIRST PRIZE, 3*l.*

250 ALFRED E. W. DARBY, Little Ness, Shrewsbury: SECOND PRIZE, 2*l.*

CLASS 31.—*Crèvecœur Cock and One Hen.*

254 JOHN T. CALVERT, Keighley, Yorkshire: FIRST PRIZE, 3*l.*

260 SAMUEL W. THOMAS, Glasfryn Villas, Cockett, Swansea: SECOND PRIZE, 2*l.*

255 JOHN T. CALVERT, Keighley: THIRD PRIZE, 1*l.*

259 RICHARD MAXWELL, Stanwix, Carlisle: the *Reserve Number* and *Highly Commended.*

CLASS 32.—*Crèvecœur Cockerel and One Pullet.*

265 RICHARD MAXWELL, Carlisle: FIRST PRIZE, 3*l.*: and SECOND PRIZE,
266 2*l.*, for 266.

261 JOHN T. CALVERT, Keighley: THIRD PRIZE, 1*l.*

264 WILLIAM JACKSON, Bolton-le-Sands, Carnforth: the *Reserve Number.*

CLASS 33.—*Black Red Game Cock and One Hen.*

269 CHARLES W. BRIERLEY, Rosedale, Tenbury, Worcestershire: FIRST PRIZE, 3*l.*

270 JAMES NELSON, Cockshaw, Hexham, Northumberland: SECOND PRIZE, 2*l.*

268 WILLIAM ALLON, Penshaw Lane, Fence Houses, Co. Durham: THIRD PRIZE, 1*l.*

271 WILLIAM SCOTT, West Shaftoe Cottage, Capheaton, Northumberland: the *Reserve Number.*

CLASS 34.—*Black Red Game Cockerel and One Pullet.*

273 CHARLES W. BRIERLEY, Tenbury: FIRST PRIZE, 3*l.*

272 ROBERT AIREY, High Row, Roddymore, Crook, Co. Durham: the *Reserve Number.*

CLASS 35.—*Brown Red Game Cock and One Hen.*

277 CHARLES W. BRIERLEY, Tenbury: FIRST PRIZE, 3*l.*: and SECOND PRIZE,
278 2*l.*, for 278.

279 JAMES W. BROCKBANK, The Croft, Kirksanton, Carnforth: THIRD PRIZE, 1*l.*

282 GEORGE F. WARD, Hadnall Hall, Shrewsbury: the *Reserve Number* and *Highly Commended.*

CLASS 36.—*Brown Red Game Cockerel and One Pullet.*

[No Award.]

CLASS 37.—*Any other variety—Game Cock and One Hen.*

281 CHARLES W. BRIERLEY, Tenbury: FIRST PRIZE, 3*l.*: and SECOND PRIZE,
289 2*l.*, for 289.

290 JAMES W. BROCKBANK, Carnforth: THIRD PRIZE, 1*l.*

294 MATTHEW STOREY, Chirm, Long Horsley, Morpeth, Northumberland: the *Reserve Number* and *Highly Commended.*

CLASS 38.—*Any other variety—Game Cockerel and One Pullet.*

296 JAMES W. BROCKBANK, Carnforth: FIRST PRIZE, 3*l.*

295 CHARLES W. BRIERLEY, Tenbury: SECOND PRIZE, 2*l.*

298 JOSEPH and THOMAS CURRAH, Woodcroft, Frosterley, Co. Durham: THIRD PRIZE, 1*l.*

297 JAMES W. BROCKBANK: the *Reserve Number.*

CLASS 39.—*Cock and One Hen, any other variety.*

305 JOB RAWNSLEY, Langley Farm, Bingley, Yorkshire: FIRST PRIZE, 3*l.*:
304 and SECOND PRIZE, 2*l.*, for 304 (Polands).

309 GEORGE F. WARD, Shrewsbury: THIRD PRIZE, 1*l.* (Malays).

300 ROBERT BUTTERFIELD, Nafferton Hall, Hull: the *Reserve Number* and *Highly Commended* (Polands).

CLASS 40.—*Cockerel and One Pullet, any other variety.*

314 JOHN FRAYN, St. Stephen's, Launceston, Cornwall: FIRST PRIZE, 3*l.* (Malays).

313 MRS. FRANKLIN, Syston Old Hall, Grantham: SECOND PRIZE, 2*l.* (Wyandottes).

317 JOB RAWNSLEY, Bingley: THIRD PRIZE, 1*l.* (Polands).

315 EDWARD KENDRICK, JUN., Weeford House, Lichfield: the *Reserve Number* (Wyandottes).

DUCKS.

CLASS 41.—*Aylesbury Drake and One Duck.*

319 ROBERT BUTTERFIELD, Nafferton Hall, Hull: FIRST PRIZE, 3*l.*

320 MATTHEW STOREY, Chirm, Long Horsley, Morpeth: SECOND PRIZE, 2*l.*

318 ROBERT BUTTERFIELD: THIRD PRIZE, 1*l.*

321 MRS. JACOB WILSON, Chillingham Barns, Belford: the *Reserve Number.*

CLASS 42.—*Aylesbury Young Drake and One Duckling.*

322 ROBERT BUTTERFIELD, Nafferton Hall, Hull: FIRST PRIZE, 3*l.*: and
323 SECOND PRIZE, 2*l.*, for 323.

327 MRS. JACOB WILSON, Belford: THIRD PRIZE, 1*l.*

CLASS 43.—*Rouen Drake and One Duck.*

328 MRS. F. DAVIS, Woolashill, Pershore, Worcestershire: FIRST PRIZE, 3*l.*

330 JOHN W. FAWCETT, Beela House, Old Hutton, Kendal, Westmoreland: SECOND PRIZE, 2*l.*

339 THOMAS WAKEFIELD, High Street, Golborne, Lancashire: THIRD PRIZE, 1*l.*

333 W. J. RILEY, Highgate, Kendal, Westmoreland: the *Reserve Number* and *Highly Commended.*

CLASS 44.—*Rouen Young Drake and One Duckling.*

348 FREDERICK STREET, Somersham Park, St. Ives, Hunts: FIRST PRIZE,
347 3*l.*: and SECOND PRIZE, 2*l.*, for 347.

349 THOMAS WAKEFIELD, Golborne: THIRD PRIZE, 1*l.*

345 W. J. RILEY, Kendal: the *Reserve Number* and *Highly Commended.*

CLASS 45.—*Drake and One Duck, any other variety.*

354 MRS. F. DAVIS, Pershore: FIRST PRIZE, 3*l.* (Pekin).
361 MRS. JACOB WILSON, Belford: SECOND PRIZE, 2*l.* (East Indian).
352 THOMAS ALLEN, Crookwood, Devizes: THIRD PRIZE, 1*l.* (Pekin).
355 EGBERT E. ELLIOTT, Southleigh, Witney, Oxon: the *Reserve Number* and *Highly Commended* (Pekin).

CLASS 46.—*Young Drake and One Duckling, any other variety.*

363 HERBERT GRIFFITHS, The Rake, Hawarden, Flints: FIRST PRIZE, 3*l.* (Pekin).
362 THOMAS ALLEN, Devizes: SECOND PRIZE, 2*l.* (Pekin).
365 MRS. JACOB WILSON, Belford: THIRD PRIZE, 1*l.* (East Indian).
364 FRANK HEUGH, Market Place, Bedale: the *Reserve Number* (Pekin).

GEESE.

CLASS 47.—*Gander and One Goose.*

371 CHARLES RICHARD LYNN, Church Farm, Stroxton, Grantham: FIRST PRIZE, 3*l.* (Toulouse).
367 JOHN EWART, Ellen Hall Mill, Cockermouth, Cumberland: SECOND PRIZE, 2*l.* (Toulouse).
369 KENNETH HUTCHINSON, Egglestone Hall, Darlington, Co. Durham: THIRD PRIZE, 1*l.* (Embden).
373 JOHN E. WATSON, Gilcrux, Cockermouth: the *Reserve Number* and *Highly Commended* (Toulouse).

CLASS 48.—*Young Gander and One Gosling.*

374 HENRY BRITTEN, Skirwith Abbey, Penrith, Cumberland: FIRST PRIZE, 3*l.* (Toulouse).
375 GEORGE E. DAWDY, Brooke Farm, St. Margaret's, South Elmham: SECOND PRIZE, 2*l.* (Toulouse).
378 GEORGE POUNDER, Kirby Moorside, York: THIRD PRIZE, 1*l.*
376 JOHN EWART, Cockermouth: the *Reserve Number* and *Highly Commended* (Toulouse).

TURKEYS.

CLASS 49.—*Black or Bronze Cock and One Hen.*

382 EDWARD KENDRICK, JUN., Weeford House, Lichfield: FIRST PRIZE, 3*l.*
381 JOSEPH DONALD, High Street, Wigton, Cumberland: SECOND PRIZE, 2*l.*
383 JOHN MAUGHAN, Blackwell, Carlisle: THIRD PRIZE, 1*l.*
387 MRS. I. SHENTON, Bangley, Tamworth: the *Reserve Number* and *Highly Commended.*

CLASS 50.—*Black or Bronze Cockerel and One Poult.*

395. MRS. I. SHENTON, Bangley: FIRST PRIZE, 3*l.*
390 EDWARD KENDRICK, JUN., Lichfield: SECOND PRIZE, 2*l.*: and THIRD PRIZE, 1*l.*, for 390.
396 MRS. I. SHENTON: the *Reserve Number* and *Highly Commended.*

CLASS 51.—*Any other colour*—(No Entry).

Class 52.—*Any other colour—Cockerel and One Poult.*

401 Edward Kendrick, Jun., Lichfield: First Prize, 3*l.*: and Second
402 Prize, 2*l.*, for 402.

399 George E. Dawdy, South Elmham: Third Prize, 1*l.*, and the *Reserve*
400 *Number* for 400.

PRACTICAL EXAMINATION IN BUTTER-MAKING.

Elizabeth Stevenson, Bowburn House, Durham: First Prize, 5*l.*, and Certificate of Efficiency.

Ernest Edward Giles, 31, St. Petersburgh Place, Bayswater: Second Prize, 3*l.*, and Certificate of Efficiency.

Sarah Carr, Durham Riding Farm, Prudhoe-on-Tyne: Third Prize, 2*l.*, and Certificate of Efficiency.

Margaret Hunter, Sunny Bank, Witten-le-Wear, Darlington, Co. Durham: *Commended.*

HORSE-SHOEING COMPETITION.

Confined to Northumberland, Durham, Cumberland, and Westmoreland.

Class 1.—*Agricultural Horses.*

7 Isaac Wills, Green Spot, Wigton, Cumberland: First Prize, 6*l.*

5 Charles Stafford, 15, Wellington Street, Newcastle-on-Tyne: Second Prize, 4*l.*

6 William Surtees, 22, Jefferson Street, Newcastle-on-Tyne: Third Prize, 3*l.*

2 John Hunter Eastwood, West Acomb, Hexham, Northumberland: Fourth Prize, 2*l.*

3 John Frazer, 55, Cook Street, Byker, Newcastle-on-Tyne: Fifth Prize, 1*l.*

Class 2.—*Dray Horses.*

14 Charles Watso , W aggon Yard, High Street, Gateshead, Co. Durham: First Prize, 6*l.*

9 James Binnie, 131, Percy Street, Newcastle-on-Tyne: Second Prize, 4*l.*

10 William Jamieson, Villa Cottage, Corporation Street, Newcastle-on-Tyne: Third Prize, 3*l.*

13 Henry Scott, 19, Jackson Street, Gateshead: Fourth Prize, 2*l.*

11 Thomas Little, Queen's Head Yard, Pilgrim Street, Newcastle-on-Tyne: Fifth Prize, 1*l.*

Class 3.—*Hunters.*

23 James Rogers, 131, Percy Street, Newcastle-on-Tyne: First Prize, 6*l.*

24 John Taylor, 62, Mansfield Street, Newcastle-on-Tyne: Second Prize, 4*l.*

16 William Auld, Arden Street, Darlington, Co. Durham: Third Prize, 3*l.*

17 Andrew Cooper, Market Place, Corbridge-on-Tyne: Fourth Prize, 2*l.*

19 Robert Graham, 41, North Road, Durham: Fifth Prize, 1*l.*

CLASS 4.—*Roadsters.*

38 WILLIAM SANDS, 28, Barclay Street, Monkwearmouth, Co. Durham: FIRST PRIZE, 6*l.*

40 THOMAS SLACK, Arthur's Square, Leayes Lane, Newcastle-on-Tyne: SECOND PRIZE, 4*l.*

42 CHRISTOPHER WILLS, Burgh-by-Sands, Cumberland: THIRD PRIZE, 3*l.*

29 EDWARD AULD, Arden Street, Darlington: FOURTH PRIZE, 2*l.*

37 JAMES ROBSON NEWTON, Heaton Junction, Byker, Newcastle-on-Tyne: FIFTH PRIZE, 1*l.*

IMPLEMENTS.

CLASS 1.—*Portable Agricultural Engine, self-moving or otherwise, on the compound principle, not exceeding eight-horse power.*

ART.

3124 DAVEY PAXMAN AND Co., Standard Iron Works, Colchester: THE PRIZE, 200*l.*

CLASS 2.—*Portable Agricultural Engine, self-moving or otherwise, on the simple principle, not exceeding eight-horse power.*

3125 DAVEY PAXMAN AND Co.: THE PRIZE, 100*l.*

CLASS 3.—*Weighing Machine for Sheep and Pigs.*

2304 DAVID HART AND Co., Wenlock Road, City Road, London: THE PRIZE, 20*l.*

CLASS 4.—*Weighing Machine for Horses and Cattle.*

2305 DAVID HART AND Co.: THE PRIZE, 25*l.*

CLASS 5.—*Machine for Planting Potatoes.*

[No Award.]

CLASS 6.—*Machine for raising Potatoes, the price to exceed* 5*l.*

1835 POWELL BROTHERS AND WHITAKER, Cambrian Iron Works, Wrexham: THE PRIZE, 20*l.*

CLASS 7.—*Implement for raising Potatoes, the price not to exceed* 5*l.*

1576 JOHN GREGORY, Westoe, South Shields: THE PRIZE, 20*l.*

CLASS 8.—*One-man power Cream Separator, the price not to exceed* 20*l.*, *and to be capable of dealing with* 20 *gallons of milk per hour.*

971 THE DAIRY SUPPLY Co., Museum Street, London, W.C.: THE PRIZE, 25*l.*

SILVER MEDALS.

420 THOMAS T. MAYOS, Llangunnock, Ross, Herefordshire: for *Straw Trusser* or *Bolting Tier.*

519 BARNARD AND LAKE, Rayne Foundry, Braintree, Essex: for *Thatch-making Machine.*

1737 JOHN FOWLER AND Co., Steam Plough Works, Leeds: for *Anti-Balance Gear to Steam Plough.*

FARM PRIZES.*

CLASS 1.—*For the best managed Arable and Grass Farm, exceeding 300 acres.*

1 G. M. ANGUS, High House, Matfen, Newcastle: FIRST PRIZE, 50*l*., and the CHAMPION PRIZE, 100*l*.*

3 J. K. LYALL, Peepy, Stocksfield-on-Tyne: SECOND PRIZE, 25*l*.

5 W. A. WEIGHTMAN, Hall Farm, Silksworth, Sunderland: the *Reserve Number* and *Highly Commended.*

2 MESSRS. ANGUS, Bearl, Stocksfield-on-Tyne: *Highly Commended.*

CLASS 2.—*For the best managed Arable and Grass Farm of 100 acres, and not exceeding 300 acres.*

14 F. WILSON, Marden, Whitley, Northumberland: FIRST PRIZE, 50*l*.

7 WILLIAM DAVISON, East Mills, Morpeth: SECOND PRIZE, 25*l*.

CLASS 3.—*For the best managed combined Hill or Moor and Arable Farm, of which not less than 100 acres shall be arable, and not less than 400 acres hill or moor.*

16 GEORGE DRYSDALE, Great Ryle, Alnwick: FIRST PRIZE, 50*l*.

17 HEDLEY DAVISON, Scrainwood, Rothbury: SECOND PRIZE, 25*l*.

15 A. BARBER, Westwood, Wooler: the *Reserve Number* and *Commended.*

The Judges in Classes 1, 2 and 3 recommend to the Council the award of Certificates for distinguished merit in discharge of their duties to ADAM HINDMARSH, shepherd in the employment of Mr. George Drysdale 26 years; to CHRISTOPHER POLLARD, shepherd with Mr. G. M. Angus and his father 27 years; to JAMES WEATHERBURN, Steward with Mr. Hedley Davison for 10 years; and to RALPH MILBURN, in the employment of Mr. Knox Lyall as Steward for 35 years.

CLASS 4.—*For the best managed Dairy Farm of 75 acres and upwards, where the management and cultivation are most successfully directed to the production of milk, butter, or cheese.*

4 J. REAY, East Brunton Farm, Newcastle: FIRST PRIZE, 50*l*.

18 S. FAIRBAIRN, South Gosforth Farm, Newcastle: SECOND PRIZE, 25*l*.

22 J. THOMSON, Whitchester, Wylam, Newcastle: *Highly Commended.*

23 W. TROTTER, South Acomb, Stocksfield-on-Tyne: *Commended.*

CLASS 5.—*For the best managed Arable and Grass Farm of 100 acres and upwards, occupied and carried on in conjunction with a colliery.*

25 THE EARL of DURHAM, Bowes House, Fence Houses: FIRST PRIZE, 50*l*.

24 THE CRAMLINGTON COAL COMPANY, Cramlington, Newcastle-upon-Tyne: SECOND PRIZE, 25*l*.

The Judges in Classes 4 and 5 commend the Management of Seaton Delaval Coal Company, Blyth, and recommend to the Council for a Certificate of Merit for long and faithful service, JOHN STEPHENSON, who has served forty years on the farms of the Seaton Delaval Coal Company as ploughman and general farm labourer.

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* Given by the Newcastle Farmers' Club for the best managed Farm in Classes 1, 2, 3, and 4.

AGRICULTURAL EDUCATION.

Examination Papers, 1887.

EXAMINATION IN AGRICULTURE.

Maximum Number of Marks, 200. Pass Number, 100.

Wednesday, May 11*th, from* 10 *a.m. till* 1 *p.m.*

1. Give the amount of capital required for a farm, mixed husbandry, of 500 acres strong land; 100 acres pasture, and 400 arable; the arable land carrying sheep in winter on turnips.

2. How should the sum be expended?
   (*a*) Amount in stock?
   (*b*) Amount in implements?
   (*c*) Amount to be retained for current expenses?

3. Give a list of the principal implements required on the above farm.

4. Estimate the number of labourers required on the above farm.

5. State briefly the best preparation of heavy land for a mangold-crop.

6. Give the number of acres of good pasture necessary to keep a cow through the year, proportion for pasture and for hay.

7. Draw up a dietary for a dairy cow for one year.

8. In a stock of 80 dairy cows, what percentage should be allowed for drafts? How many heifer calves should be reared from such a stock?

9. Give the rule for ascertaining the weight of cattle by measurement, with an example.

10. A beast being moderately fat, what percentage should be allowed for offal?

11. State briefly the best means of saving a crop of turnips when attacked by the Turnip Flea-Beetle, commonly known as "fly."

12. Of what is the wire-worm a grub? How long does it exist in the wire-worm form?

13. Describe briefly the effect of the "Ox Warble-Fly" on cattle, the best means of preventing its attack, and the best method of destroying the grub.

14. Describe the grub of the "Daddy-Longlegs," and state the best method of treatment when these insects are injuring corn crops.

15. When should ewes be put to the ram to lamb down in March?

16. Give the average weight of a Lincoln or Leicester hog fleece, and of a Shropshire hog fleece.

17. Give the periods of gestation of the following:—Mare, cow, ewe, sow.

18. What amount of food per week should an average cart-horse have to keep him in good condition for hard work, and how much in slack time? Give the prices of food in each case.

EXAMINATION IN CHEMISTRY.

Maximum Number of Marks, 200. Pass Number, 100.

I. Agricultural Chemistry.

Tuesday, May 10th, from 2 p.m. till 5 p.m.

1. What are the principal points of difference which would be shown in the chemical analyses of the following kinds of soil:—a sandy soil, a heavy clay, a loamy soil, a marly soil, a peaty soil?

2. What do you understand by the term "nitrification" as applied in agriculture? Explain its action, and illustrate its bearing on questions of crop manuring, stating what conditions increase or retard its action.

3. Explain the changes which may take place in the constituent parts of soils as the result of "paring and burning." On what kinds of soil, and under what circumstances is the operation conducted with benefit, and when would it be disadvantageous?

4. Describe in chemical language the different forms in which phosphoric acid exists in combination with lime in the following materials:—raw bones; steamed bones; bone dust; dissolved bones; ground coprolites; mineral superphosphate; precipitated phosphate; apatite; Peruvian guano.

Compare these materials as regards the action and value of the phosphates they severally contain, mentioning circumstances that may produce varying results.

5. What is "basic cinder," or, as sometimes termed, "Thomas' phosphate powder"? How, and under what circumstances is it obtained commercially? On what grounds may it be considered a manurial substance of value, and what circumstances may affect this value?

6. Give approximate analyses showing the differences of chemical composition between the following: — milk (cow's); colostrum; cream; skim-milk; butter; cheese (rich); cheese (from skim-milk).

7. What feeding materials in common use are specially useful on account of the oil they contain, which for the nitrogenous constituents,

which for starch, which for sugar? Give the percentage amount of the selected ingredient generally found in the foods named.

8. Write a short paper illustrative of the influence of climate and season on the growth of crops.

II. General Chemistry.

Tuesday, May 10th, from 10 a.m. till 1 p.m.

1. Explain how to find the proportion of (1) oxygen, (2) carbonic acid gas, in the atmosphere.

2. Describe and explain the preparation of chlorine. Chlorine often acts as an oxydizing agent: explain this.

3. Describe the chief physical and chemical characters of (1) wood charcoal, (2) silica, (3) lime, (4) aluminium hydroxide.

4. Sunshine is said to do work against chemical forces in the growth of plants: explain this statement.

5. Shew how to determine the amount of ammonia in a mixture of sulphates of ammonia and soda and lime.

6. Explain the relation between the compound formed when phosphorus is burnt in air and common phosphoric acid. Also the relations between the acids known as ortho-, meta-, and pyro-phosphoric. Give examples of other acids between which a similar relation occurs.

7. Explain under what circumstances nitrates are formed naturally. Determine the percentage of nitrogen in potassium nitrate and in calcium nitrate, respectively. (K = 39, Ca = 40.)

8. State the composition of urea, and give an account of its chief chemical characters. How may it be made to yield ammonia?

9. Explain the conditions under which acetic acid is produced. Give examples of other acids of the same type as acetic acid, and point out wherein they resemble one another.

EXAMINATION IN MENSURATION AND LAND SURVEYING.

Maximum Number of Marks, 100. Pass Number, 50.

Thursday, May 12th, from 2 p.m. till 5 p.m.

1. State rules for finding the area of a sector of a circle, and of a segment of a circle.

The angle of a sector is 55°, the radius of the circle is 120 ft.; find the area of the sector, and of the segment cut off by the chord subtending the angle of the segment.

2. Find in square inches the area of the surface of a globe 20 in. in diameter.

3. A reservoir has its ends vertical, but its sides slope at the rate of 2 vertical to 1 horizontal; its bottom is a rectangle 40 ft. wide and 200 ft. long. When the reservoir is full to the brim the water is 20 ft. deep. Find the number of cubic feet of water it then holds, and how much the surface sinks, when half the water is allowed to run out. (N.B. $\sqrt{26} = 5{\cdot}099$.)

4. A cubic box of wrought iron is made of plates half-an-inch thick; externally the edge is 2 ft. long. Find the weight of the box, assuming the specific gravity of wrought-iron to be 7·8, and the weight of a cubic foot of water to be 1000 oz.

5. A, B, C, D are four points in order along a straight road; the horizontal distances A B, B C, C D are 200 ft. apiece. A level is set up and adjusted anywhere on the line of the road; the staff is then placed successively at A, B, C, D, and the readings are found to be 3·25 ft., 7·80 ft., 6·625 ft., 2·50 ft. respectively. Draw a section of the road in which the vertical scale is to the horizontal scale as 20 to 1; find also the slope of the road between C and D.

6. If the scale of a map is 5 in. to the mile, what is the length of the line that represents $7\frac{3}{4}$ miles? And what is the length of the side of a square that represents an area of 40 square miles?

7. Give a brief description of the vernier. If, on a scale of inches, each inch is divided into 5 equal parts, how can a vernier be drawn to enable an observer to read the scale to 1-25th of an inch?

8. A four-sided piece of ground is bounded by a wall which you cannot see over, and within which you must not go; how could you lay down a plan of the ground, having nothing but a measuring tape, a few pickets and a mallet. Of course it is to be assumed that all the ground outside the wall is accessible. Would your method be applicable to a piece of ground with more than four sides?

9. State the steps by which the third side of a triangle can be calculated, when two sides and the included angle are known.

If the two sides are 21,574 ft. and 25,345 ft. long, and contain an angle of 71° 18′; find, approximately by construction, and accurately by calculation, the remaining angles and the third side of the triangle.

EXAMINATION IN MECHANICS AND NATURAL PHILOSOPHY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Thursday, May 12th, from 10 *a.m. till* 1 *p.m.*

1. Name the units of time, distance, and mass commonly used in Natural Philosophy, and state how they are determined.

Explain how a unit of force can be derived from them.

2. State how to find the resultant of two intersecting forces.

Find, by construction or calculation, how forces of 4 and 3 units must act at a point that their resultant may be a force of 2 units.

3. A uniform rod A B of given weight (100 lbs.) can turn freely round a hinge at A; it rests against a smooth point very near the end B; A B is inclined at an angle of 30° to the horizon, B being higher than A. Show in a diagram how the reactions of the fixed point and of the hinge act, and find their magnitudes by construction or calculation.

4. Show in a diagram how to arrange three pulleys into a "system" in any one way; and find, on the usual suppositions, the relation between the power and the weight in the system shown in your diagram.

5. Define a foot-pound and a horse-power.

An engine is required to work with 112 horse-power in order to draw a train with a constant velocity of 42 miles an hour; against what resistance does the train move?

6. A body weighing 50 lbs. moves at the rate of 60 ft. a second; what number of foot-pounds of work is it able to do in virtue of its mass and velocity? ($g = 32$). If it moves against a constant resistance of 10 lbs., how far would it move before coming to rest?

7. Describe the common siphon, and explain its action.

Show that it follows from your explanation that water cannot be drawn by a siphon from a lower to a higher level.

8. Define the specific heat of a substance.

If 3 lbs. of mercury at 100° C are mixed with 1 lb. of ice-cold water, and the resulting temperature of the mixture is 9° C, compare the specific heat of mercury with that of water, assuming that no heat is lost in the process.

9. Define a crank and a connecting rod.

If the crank revolves with a constant angular velocity, and one end of the connecting rod describes a portion of a straight line passing through the centre of the crank; find, for any given position of the crank, the relation between the velocity of that end of the connecting rod and the velocity of the end of the crank.

EXAMINATION IN BOOK-KEEPING.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Friday, May 13th, from 10 a.m. till 1 p.m.

Journalize and post the following Book-keeping transactions, which are supposed to have taken place during the month of January, 1887; and draw out Trial Balance, Profit and Loss Account, and Balance Sheet.

Capital on the 1st January, £3068 13*s.* 9*d.*, represented by :—

Assets.				£	*s.*	*d.*
Cash at Bank				250	6	3
Cash in house				10	15	6
T. Sarl's acceptance due 8th January, and paid into Bank for collection				343	13	8
Lease of premises, 19 years to run				380	0	0
Plant and utensils				500	0	0
Debts due from :—						
A. Biggs	190	16	2			
G. Crump	360	14	8			
T. Sarl	308	13	8			
				860	4	6
Stock of Goods				2718	6	11
				£5063	6	10
Liabilities.						
Acceptances (made payable at Bankers)—						
Due 4th January	90	4	3			
„ 16th February	183	16	8			
	274	0	11			
Loan from C. Munns (bearing interest at 5 per cent. per annum)	1400	0	0			
Debt due to T. Mills	320	12	2			
				1994	13	1
				£3068	13	9

	£	*s.*	*d.*
Sold to A. Biggs—goods	246	14	3
Received of A. Biggs, and paid in to Bank	150	0	0
Bought of T. Mills—goods	438	5	3
T. Sarl's acceptance due 8th January, returned dishonored with noting charges (paid by Bankers) 1*s.* 6*d.*	343	15	2
Written off from T. Sarl's account as a bad debt	217	9	1
Received of G. Crump and paid in to Bank	351	14	4
Allowed discount to G. Crump	9	0	4
Sold to G. Crump—goods	413	13	2
New machinery bought and paid for by cheque	140	0	0
Drawn from bankers on private account	50	0	0
Drawn from bankers for house cash	25	0	0
Paid out of house cash for salaries and wages	28	13	4
Paid out of house cash for petty trade expenses	6	9	6
Passed to C. Munn's account for interest	5	16	8
Written off for depreciation on lease	1	13	4
„ „ on plant	2	1	8
Stock on hand at end of the month	2605	16	5

EXAMINATION IN GEOLOGY.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.

Friday, May 13th, from 2 p.m. till 5 p.m.

1. From what material is *Lime* obtained? Describe the process and its results.

2. What are the best native *Building Stones* in any three Counties of England?

3. Write out a Table of the *Palæozoic Formations;* mention some of their leading *Fossils;* and state where they are chiefly found in the British Isles.

4. What Counties in England have the broadest extent of *Clay Lands?* To what Geological Formations do these several Clays belong? What is their chief agricultural produce?

5. Draw a Geological Section across any part of the British Isles, and describe it in detail.

6. What is *Silica?* What minerals and rocks have it largely in their composition?

7. What is meant by *Dip* and *Strike?* What is the chief *Strike* of the strata in England? Illustrate your answer by diagrams.

8. Name any *Fossils* by which you would recognize Silurian, Carboniferous, Rhætic, Oolitic, and Cretaceous rocks respectively.

9. In what respects may a knowledge of Geology help you in *Draining*, and in *Sinking for Water* by wells and borings?

10. Write a brief account of the Geology and Physical Geography of any one large County in England, or Scotland, or Ireland.

11. Define *marl, shale, slate, schist, basalt,* and *granite.* For what purposes are these used?

12. Name and describe the Specimens on the Table.

EXAMINATION IN BOTANY.

[It is expected that Eight Questions at least will be answered.]

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.

Saturday, May 14th, from 10 a.m. till 1 p.m.

1. Describe the structure and contents of an active vegetable cell.

2. What is phyllotaxy?

3. Describe the structure and state the functions of the leaf.

4. Describe the growth of the root and of the stem, and explain the reason for any differences in the methods of growth.

5. What is the morphological nature of the fruits of the following plants:—Cherry, strawberry, fig, apple, buttercup, and pea?

6. What are the characters of Gymnosperms and Angiosperms—of Dicotyledons and Monocotyledons,—and of Polypetalæ, Gamopetalæ, and Apetalæ? Give an example of each group.

7. State the reasons for the special value to the plant of nitrogenous manures.

8. What methods can be adopted for producing new varieties in cultivated plants?

9. Give an account of the life history of mildew in wheat, and specify the names given to the plant in its various stages.

10. State the grasses you would employ in laying down a drained loam field to permanent pasture, and give the reasons for your selection.

11. What are the technical names and natural orders of the following plants:—Buttercup, Yorkshire fog, yarrow, sheeps' parsley, self-heal, and catch-fly?

12. Name and describe, in systematic order, the plants marked A, B, and C.

EXAMINATION IN ANATOMY AND ANIMAL PHYSIOLOGY.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.

Saturday, May 14th, from 2 p.m. till 4 p.m.

1. Describe the process of respiration and name the chief organs, including the muscles, which are employed in the act. Say, if any, and if so, what difference exists in the Horse compared with the Ox.

2. Name the chief changes which are produced in the blood by respiration.

3. Describe the general structure, position and size of the heart of the Horse or Ox, naming its several cavities and the vessels connected therewith. Say also what is the condition of the blood in each.

4. Supposing a portion of an artery and a vein of about equal size to be placed before you, say how you would readily distinguish the one from the other.

5. Name the position which the liver occupies in the abdominal cavity. State the nature of its secretion and uses in the animal economy. Name also the chief peculiarity which exists in the Horse in relation to its excretory ducts.

6. Describe the component parts of the skin, including the several follicles. Say also upon what the temporary erection of hairs in various parts of the body depends.

7. Describe the structure of horn and explain the relationship which exists between it and the skin.

8. State what parts of the hoof of the Horse sustain the weight of the animal, whether he is shod or unshod, at rest or in motion, giving proofs by experiments which have been adopted.

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W. Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, Thursday, December 8th, 1887, at noon.

GENERAL MEETING in London, Monday, May 22nd, 1888, at noon.

MEETING at Nottingham, July, 1888.

MONTHLY COUNCIL (for transaction of business), at noon on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays, 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on page cxxxvii in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page cxxxiv).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (pages cxxxix and cxl).

SUBSCRIPTIONS.—1. *Annual.*—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. *For Life.*—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member. No Governor or Member can be allowed to enter into composition for life until all subscriptions due by him at the time shall have been paid. Governors or Members not resident in the United Kingdom, will be required on election to pay the life composition. No Governor or Member in arrear of his subscription is entitled to any of the privileges of the Society.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of postal orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker or any other house of business in London will be equally available, if made payable on demand. In obtaining postal orders care should be taken to give the postmaster the correct name of the Secretary of the Society (Ernest Clarke), otherwise the payment may be refused to him at the post-office on which such order has been obtained; and when making remittances it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be crossed "London and Westminster Bank." On application to the Secretary, forms may be obtained for authorizing the regular payment, by the bankers of individual members, of each annual subscription as it falls due. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper person. No coin can be remitted by post, unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary. The Secretary will inform new Members of their election by letter.

*** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

THE Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *bonâ-fide* and sole use of Members of the Society. Members have also the privilege of sending samples for Analysis on behalf of any farming company of which they may be directors or managers, provided that the substances so sent shall be for use on the farm of the Company and not for sale to other persons. Members of the Society are also allowed to send to the Society's Laboratory for analysis, at the same scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants, or which they propose to give free of cost to their occupying tenants.

These analyses are given on the understanding that they are required for the individual and sole benefit of the Member applying for them, and must not be used for other persons, or for commercial purposes. Except in case of dispute, the analyses and reports must not be communicated to either vendor or manufacturer. Land or Estate Agents and others sending samples for analysis on behalf of their principals are only entitled to do so when the latter are themselves Members of the Society. The names of the principals should in such cases be given. To avoid all unnecessary correspondence, Members are particularly requested, when applying to the Consulting Chemist, to mention the kind of analysis they require, and to quote its number in the subjoined schedule.

The charge for analysis, together with the cost of the carriage of the specimens (if any), **must be paid to the Consulting Chemist at the time of application.**

No.		
1.	An opinion of the genuineness of bone-dust or oil-cake (each sample)	2*s.* 6*d.*
2.	An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda	5*s.*
3.	An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	5*s.*
5.	An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
6.	An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it	10*s.*
7.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
8.	An analysis of limestone, showing the proportion of lime and magnesia	10*s.*
9.	An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay	10*s.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s*
11.	Complete analysis of a soil	£3
12.	An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties	10*s.*
13.	Analysis of any vegetable product	10*s.*
14.	Analysis of animal products, refuse substances used for manures, &c. ..	from 10*s.* to £1
15.	Determination of the "hardness" of a sample of water before and after boiling ..	5*s.*
16.	Analysis of water of land-drainage, and of water used for irrigation	£1
17.	Analysis of water used for domestic purposes	£1 10*s.*
18.	Determination of nitric acid in a sample of water	10*s.*
19.	Examination of Viscera for Metallic poison	£2 2*s.*
20.	Examination of Viscera complete, for metals and alkaloids	£5 5*s.*
21.	Personal consultation with the Consulting Chemist. (The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment, it is suggested that Members desiring to hold a consultation with the Consulting Chemist should write to make an appointment)	5*s.*
22.	Consultation by letter	5*s.*
23.	Consultation necessitating the writing of three or more letters	10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, requests that all letters and parcels (postage and carriage paid) from Members of the Society, who are entitled to avail themselves of the foregoing Privileges, should be directed.

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

Feeding Cakes.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.

2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.

3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

Artificial Manures.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain not less than 45 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.

2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain not less than 48 per cent. of tribasic phosphate of lime, and to yield not less than 1¾ per cent. of ammonia.

3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.

4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.

5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.

6. *Nitrate of Soda* should be guaranteed by the vendor to contain from 94 to 95 per cent. of pure nitrate.

7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 23 per cent. of ammonia.

8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12, HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples between 8 and 12 oz. can be sent by parcels-post for three postage stamps.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12, HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcels-post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid.

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any Member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a visiting Inspector will be 2*l*. 2*s*. each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in cases of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the results of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector	10*s*. 6*d*.
Consultation by letter	10*s*. 6*d*.
Post-mortem examination, and report thereon	21*s*.

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s*. 6*d*. per week each animal, and for sheep and pigs, 3*s*. 6*d*. per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan	Not yet appointed.
Carmarthen	ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester..	W. Lewis, 1, South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.

County.	*Name and Address.*
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset...	W. Vessey, Weymouth.
Durham	H. Peele, Tower Street, West Hartlepool.
Essex	James Taylor, Vengewell Hall, Wix, Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Professor Nicholson Almond, Royal Agricultural College, Cirencester.
Hants	J. D. Barford, 57, Above Bar, Southampton.
Hereford	W. Good, 30, Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	J. B. Polding, Red Lion Street, Burnley.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)..	Charles Hartley, 4, Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1, Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College, Camden Town.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	Calver and Smith, Downham Market.
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmoreland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	C. Gresswell, Albert Square, Derby Road, Nottingham.
Oxford	Chas. N. Page, Banbury.
Pembroke	Not yet appointed.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	Mr. J. Worsley, Ipswich.
Surrey	J. I. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	J. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28, Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz.:—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical Privileges.

The Council have fixed the following rates of charge for the examination, by the Society's Consulting Botanist, of Plants and Seeds, for the *bonâ fide* and individual information and benefit of Members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

No.		
1.	—A report on the purity, amount, and nature of foreign materials, the perfectness, and germinating power of a sample of seed ..	5*s.*
2.	—Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention	5*s.*
3.	—Report on any disease affecting farm crops	5*s.*
4.	—Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value	10*s.*

N.B.—The Consulting Botanist's Reports are furnished to enable Members,—purchasers of seeds and corn for agricultural or horticultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes.

PURCHASE OF SEEDS.

The purchaser should obtain from the vendor, by invoice or otherwise, a proper designation of the seed he buys, with a guarantee that it contains not more than a specified amount of other seeds, and is free from ergot, or, in the case of clovers, from dodder, and of the percentage of seeds that will germinate.

The germination of cereals, green crops, clovers, and timothy grass should be not less than 90 per cent.; of fox-tail, not less than 60 per cent.; of other grasses not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

I. Seeds.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds, the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser and not from the purchase sample. When bought by sample the whole or part of that sample should be sent.

When it is considered necessary to secure legal evidence, the sample should be taken from the bulk and placed in a sealed bag in the presence of a reliable witness, who is acquainted with the identity of the bulk, and care should be taken that the purchased sample and bulk be not tampered with after delivery, or mixed or come in contact with any other sample or stock.

One ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which each sample has been bought should be sent with it.

Grass-seeds should be sent at least FOUR WEEKS, *and clover-seeds* TWO WEEKS *before they are required, and they should not be sown until the report has been received.*

II. Plants.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. They should be placed in a bottle, or packed in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S., 44, Central Hill, Norwood, London, S.E.

Members' Entomological Privileges.

The Council have fixed the charge of 2*s*. 6*d*. for the determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm-crops, with a report on its habits, and suggestions as to the methods of prevention and remedy.

Portions of the plants injured should accompany the specimens of the insects.

All specimens should be sent in tin or wooden boxes, or in quills, so as to prevent injury in transmission.

Parcels or letters containing specimens (carriage or postage paid) must be addressed to Miss E. A. Ormerod, F.R.Met.Soc., Torrington House, Holywell Hill, St. Albans.

General Privileges of Members.

Free admission to the Show-Yard and to the Grand Stand at the Country Meetings, during the time the Show is open to the public, by tickets issued by the Secretary; Exhibition of Live Stock and Implements at the Country Meetings at a reduced charge; the *Journals* of the Society which belong to the year for which their subscription has been paid, transmitted by post, free of charge, to their address; analyses of Manures, Feeding Stuffs, &c., made at a reduced charge by the Consulting Chemist (pp. cxxxv and cxxxvi), and examination of Plants and Seeds by the Consulting Botanist (p. cxxxix), and of Insects, &c., by the Consulting Entomologist (p. cxl); the liberty of consulting the books in the Library; leave to report the outbreak of disease among cattle, sheep, and pigs, and to request the personal attendance of one of the Society's Veterinary Inspectors; power of sending cattle, sheep, and pigs to the Royal Veterinary College on payment of a small sum for keep and treatment (p. cxxxvii).

No member in arrear of his subscription is entitled to any of the privileges of the Society.

All Members belonging to the Society are bound to pay their annual subscriptions, until they shall withdraw from it by notice in writing to the Secretary.

Journal.—The Parts of the Society's *Journal* are published half-yearly, and (when the subscription is not in arrear) they are forwarded by post to Members residing in the country, or delivered from the Society's office to Members or to the bearer of their written order.

The back numbers of the *Journal* are kept constantly on sale by the publisher, John Murray, 50a, Albemarle Street, W.

*** All Communications intended for the Society should be addressed to the Secretary, at the House of the Society, 12, Hanover Square, London, W. Replies by Telegraph cannot be sent unless paid for in advance, and cannot be guaranteed in any case.